THE AIR FORCE NUCLEAR ENGINEERING CENTER
STRUCTURAL ACTIVATION AND
INTEGRITY EVALUATION

THESIS

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Captain, USAF

AFIT/GNE/ENP/90M-4





DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
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Wright-Patterson Air Force Base, Ohio

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THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Nuclear Engineering

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March 1990

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## Preface

When undertaking a report of this magnitude, it is important to acknowledge individuals who assisted and helped me reach completion. Of the many individuals I would like to thank, first and foremost is my advisor, Lt. Col. Ronald Tuttle, Deputy Head of the Air Force Institute of Technology (AFIT) Engineering Physics Department. His advice contributed greatly to the direction of my studies as I worked toward completion.

When a topic involves operation of a major computer program, as this one, ORIGEN2, it is always questionable about whether you can complete the required computer runs after you understand the operation of the program. Mr. Scott Ludwig of Oak Ridge National Laboratory (ORNL) was consistently available to answer questions concerning the operation, which advanced my computer portion much quicker than expected. Another individual at ORNL, Ms. Nancy Knox, was instrumental in locating documents from the Remedial Action Program Information Center.

It is impossible to name all of the individuals that assisted in the completion of this thesis. However, I would especially like to thank my wife, Mary and our daughters for their patience and understanding during the previous months of work.

William A. Lamb

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## Abstract

The purpose of this study was to investigate three areas: (1) the entombed radioactivity of the Air Force Nuclear Engineering Center (AFNEC) Test Facility located in Area B, Building 470, Wright-Patterson AFB, Ohio, (2) the integrity of the materials incased in the concrete to determine if they would be susceptible to corrosion or deterioration, and (3) the comparison of cost of dismantlement of the existing facility or continued surveillance of the existing facility. The ORIGEN2 computer code was used to calculate an upper bound of radioactivity entombed within AFNEC. The initial calculated activity, 2,460,000 Curies, has decayed by three orders of magnitude since the cessation of operation (20 years later - 1,560 Curies). The activated structural components consisted of 5 distinct materials; aluminum, stainless steel, carbon steel, lead, and concrete. Of these materials, aluminum dominated the initial radioactivity with nearly 60% of the total activity attributed to it. The carbon steel became the dominant contributor to the total radioactivity with over 50% of the total activity at 20 years after shutdown. Stainless steel structural components will contribute over 80% of the total activity at 50 years when the calculated total radioactivity has decreased to less than 300 Curies. The integrity of the AFNEC structure was determined to adequately contain

the entombed structural radioactivity at background levels for the lifetime of the entombment. Finally, the estimated dismantling costs of $42 million projected by Martin-Marietta are within industry estimates for dismantling a nuclear reactor.

THE AIR FORCE NUCLEAR ENGINEERING CENTER
STRUCTURAL ACTIVATION AND INTEGRITY EVALUATION

## I. Introduction

The Air Force Nuclear Engineering Center (AFNEC) Test Facility is located in Building 470, Area B, Wright-Patterson Air Force Base, Ohio. All fuel elements were removed and shipped off site after the reactor shut down operation in June, 1970. After cessation of operation, the remaining structural materials were entombed within concrete. The concrete monolith was to remain in this state for 140 years; at the end of this time, the monolith is planned to be dismantled as the majority of the radioactive components would have decayed away. Additionally, the enduring long-lived radionuclides would be at a lower activity, and therefore decreased protection requirements for workers involved with dismantling the entombment. In 1986, the USAF Terrestrial Nuclear Reactor Safety Study Group (TNRSSG) directed a study to be performed to delineate the final disposition options for the decommissioned reactor. Martin-Marietta, which did a four-option investigation for the facility, completed the required study. The four options considered in the Martin-Marietta study were:

Option 1: Facility upgrade and surveillance program.
Option 2: Removal of radioactive material from inside the entombment and adjacent facilities.
Option 3: Implementation of Option 2, plus removal of concrete monolithic structure.
Option 4: The razing of all structures and restoration of the site to allow unrestricted use.

One outcome of the study was the need for a more comprehensive investigation into the radionuclide inventory contained within the entombed monolith. This study is a first step in that regard.

Background

The Air Force Nuclear Engineering Center was designed to conduct studies in support of the nuclear aircraft propulsion program. The AFNEC water-moderated. water-cooled reactor used enriched uranium clad in aluminum and had an operational design power of 10 Megawatts thermal ($MW_{th}$). The facility included test cells, beam tubes, a thermal column, and a bulk shielding facility for experiments with different types of radiation. AFNEC was operational from November 1967 through June 1970. During this period, around 79,000 $MW_{th}$ was produced (4:6-7).

Three types of decommissioning for the AFNEC were considered when operation of the reactor ceased. The three approaches considered were; immediate dismantlement, passive safe storage, and entombment. Entombment was chosen as the decommissioning option for AFNEC. At the time, other commercial reactors were being entombed and it appeared that it would be the alternative-of-choice for decommissioning of all reactors. Entombment is defined as the following:

Entombment - The radioactive materials and contaminated areas are decontaminated, the nonreleasable materials are confined within a monolithic structure, and surveillance and maintenance continue under the conditions of the nuclear license until either the confined radioactivity has decayed to unrestricted release levels or the entombment structure is dismantled (17:1-1).

To meet the entombment requirements, the nonstructural components within the facility were removed and sent to a waste storage site. Radioactive structure cavities and the irradiation test cells were filled with sand. Penetrations of the biological shield, such as pipes and ducts, were sealed by cutting the penetrations and welding over the openings with steel plates. Additional concrete shielding was poured to reduce the background reading to 0.2 mR/hr. The additional concrete became part of the entombment structure and encased the neutron activated structural components of the reactor. (3:72-88)

During this time span, three commercial nuclear reactor facilities were put into an entombed decommissioned state. These three are Hallam Nuclear Power Facility, Hallam, Nebraska; Boiling Nuclear Superheater (BONUS) Power Station, Ricon, Puerto Rico; and Piqua Nuclear Power Facility, Piqua, Ohio. General information about these three facilities is useful when disposition of the AFNEC facility is considered.

The facility at Hallam, Nebraska was entombed in 1969. The fuel elements were removed and a cover of two 12.5-mm

thick steel plates welded over the reactor area, with all penetrations seal-welded. The entire area was then covered with layers of tar, earth, and plastic film. An estimated total of 300,000 Ci of radioactivity was sealed underground. Periodic inspection is done by authorities of the state of Nebraska. Within the structure are encapsulated drawings, reports, analyses and photographs relating to the buried structures (17:4-17,4-20).

The BONUS reactor was a 50 $MW_{th}$ boiling water reactor with nuclear superheat. Operation of BONUS ceased in 1967, and the reactor was entombed in 1970. Radioactivity from the initial entombment was approximately 50,000 Ci. The most catastrophic postulated design basis accident of a severe earthquake followed by a tidal wave flood with pessimistic assumptions showed no unacceptable radiation doses to the general population (17:4-21,4-22).

The Piqua Nuclear Power Facility is of interest since it is of similar entombment design as the AFNEC facility and is currently used by the city of Piqua for power company offices and storage areas. The facility was a 45 $MW_{th}$ power reactor entombed in 1969. The reactor vessel, thermal shield, grid plates, and support barrels remained in place below grade. The reactor vessel was filled with sand and seal-welded, with all penetrations plugged and sealed. A concrete cover and waterproof barrier then sealed the below ground complex. An estimated total of 260,000 Ci of radioactivity was sealed

within the entombment. Again, detailed records of the operations were duplicated and encased within the structure (17:4-20,4-21).

Presently, the only part of the Piqua facility not in use is the reactor entombment itself. A warehouse door has been installed in the containment building and another four inches of concrete covering has been added to the cover for stability when trucks are driven into the dome. Figure 1 shows the inside of the containment dome as it is being used today.

Figure 1. Inside Piqua Nuclear Power Facility containment building on top of the entombed reactor core.

The lower levels within the dome are for storage of similar cables and electrical power equipment. The auxiliary buildings connected to the containment dome are used as offices for the Piqua power company (18).

The AFNEC facility is similar to the Piqua facility as the structural facilities and adjoining buildings were of similar design. The AFNEC facility has been entombed since July, 1971 when all the work for the entombment was completed. Since that time the AFNEC has been in the surveillance and maintenance phase. The surveillance phase consists of smear sampling done quarterly by the Health Physics section of the base. Maintenance is under the direction of AFIT (12:222-223).

By direction of the USAF Terrestrial Nuclear Reactor Safety Study Group (TNRSSG), Air Force Logistics Command (AFLC) contracted Martin Marietta to conduct a study. Martin-Marietta did a four option investigation to consider current action for the facility. The study suggested a more comprehensive investigation into the current radionuclide inventory within the entombment. This study is the first step in that regard (4:56).

## Purpose

The purpose of this thesis project is to use computational techniques to determine the current activity of entombed materials inside the Nuclear Engineering Training

Facility, Building 470, located in Area B, Wright-Patterson AFB, Ohio. Material integrity of the structural members will be discussed since the integrity of the entombed materials is paramount to the safety of the environment. Additionally, cost comparisons will be presented on whether the reactor building should be maintained in its present state with limited use of the surrounding facilities or whether it should be dismantled and the radioactive materials still entombed be disposed of elsewhere. The deciding factors for any decision regarding AFNEC are safety, cost, and public acceptance.

## Scope

The ORIGEN2 computer code was operated to determine the current radioactive inventory of radionuclides. The inputs to the computer code along with discussion of the possible sources of errors will be identified. Secondly, the stability of the entombment materials and materials entombed were analyzed. Finally, a comparison of studies done on the cost of dismantling the facility or continuing surveillance is presented. The studies contrasted were done by Martin-Marietta in 1987 and by DOE in 1978.

## II. Activity of the Entombed Reactor

The entombed radioactivity of the structural members of the AFNEC reactor are of interest when determining the total amount of radioactivity contained within the entombment. The first attempt at determining the inventory of entombed radioactivity was done by the NUS corporation in the Decommissioning Safety Report, published in December, 1970. This report described the activity of the entombed structural members from a neutron activation analysis. The report was limited to analysis of nuclides present within the structural members. The report did identify the most prominent radioactive components from neutron activation. However, while the results were credible in 1970, the computational capabilities were limitec by computers and programming of that time. With what is available today, almost twenty years later, a better estimate of the entombed radioactivity can be made.

The development of many computer codes has improved the capability to identify and calculate the activated radionuclides within reactor structural members. One such code is the ORIGEN2 computer code developed by Oak Ridge National Laboratory, Oak Ridge, Tennessee. This section describes the procedure used to determine the activation of materials. Material composition will be discussed along with the ORIGEN2 computer code calculations and results.

## Material Composition

The structural materials entombed within the AFNEC reactor comprise the radioactive components within the structure. These materials were activated from the neutron flux while the reactor was in operation. The composition of structural member materials was given in the NUS report along with a range for the amount of each element. Appendix A lists the material compositions for each part of the AFNEC facility. For the ORIGEN2 computer calculation, the highest value for each element has been used just as the NUS calculations were performed. This gives a conservative estimate since it is the upper bound for that element. In many instances, the activation of a material is a result of impurities, as in the case of aluminum, which contains silver and cobalt impurities.

The elemental composition of these materials is vital since each nuclide has a neutron cross section. The neutron cross section is a quantity used to describe the extent which neutrons interact with a nucleus. The probability that neutrons will interact with nuclei is given in the units of *barns*, which is $10^{-24} cm^2$. This cross section is used to calculate the amount of radioactive nuclides produced as a result of a neutron flux. The spectrum of neutron flux can range from energies of 14 MeV to thermal energies of 0.025 eV. The cross sections for interaction varies with these

energies. Since the cross section is a function of the energy the reactions will vary with the incident neutron energy. The cross sections are tabulated with regards to energy and input to the ORIGEN2 computer code.

ORIGEN2 Computer Code

The ORIGEN2 computer code is a code that can be used to calculate the activation of structural materials contained within a reactor. The original ORIGEN code was written by Bell and Nichols at Oak Ridge National Laboratory (ORNL) in the 1970's (13:179-196). The revised ORIGEN2 code incorporated more sophisticated reactor physics codes, a free format input, and a more highly controlled output.

ORIGEN2 solves a nonhomogeneous, first-order, ordinary differential equation using a matrix exponential method. In words, the equation is:

$$\left\{\begin{matrix}\text{rate}\\\text{of}\\\text{population}\\\text{change}\\\text{of}\\\text{the}\\\text{nuclide}\\\text{of}\\\text{interest}\end{matrix}\right\} = \left\{\begin{matrix}\text{decay}\\\text{of}\\\text{other}\\\text{nuclides}\\\text{into}\\\text{the}\\\text{nuclide}\\\text{of}\\\text{interest}\end{matrix}\right\} + \left\{\begin{matrix}\text{production}\\\text{of}\\\text{the}\\\text{nuclide}\\\text{from}\\\text{other}\\\text{nuclides}\\\text{by}\\\text{neutron}\\\text{activation}\end{matrix}\right\} - \left\{\begin{matrix}\text{removal}\\\text{of}\\\text{the}\\\text{nuclide}\\\text{of}\\\text{interest}\end{matrix}\right\} + \left\{\begin{matrix}\text{feed}\\\text{of}\\\text{the}\\\text{nuclide}\\\text{of}\\\text{interest}\end{matrix}\right\}$$

Mathematically the equation becomes:

$$\frac{dX_i}{dt} = \sum_{j=1}^{N} l_{ij}\lambda_j X_j + \phi \sum_{k=1}^{N} f_{ik}\sigma_k X_k - (\lambda_i + \phi\sigma_i + r_i)X_i + F_i$$

where,

$\frac{dX_i}{dt}$ = the rate at which the amount of nuclide $i$ changes as a function of time.
$X_i$ = atom density of nuclide $i$.
$N$ = number of nuclides.
$l_{ij}$ = the fraction of radioactive disintegrations by other nuclides which leads to the formation of species $i$.
$\lambda_i$ = radioactive decay constant.
$\phi$ = position-averaged and energy-averaged neutron flux.
$f_{ik}$ = fraction of neutron absorption by other nuclides which leads to formation of species i.
$\sigma_k$ = spectrum-averaged neutron absorption cross-section of nuclide $k$.
$r_i$ = continuous removal rate of nuclide i from the system.
$F_i$ = continuous feed rate of nuclide $i$.

There are **N** nuclides considered, so **N** equations of the same general form must be solved to yield the amount of each nuclide, $X_i$, at the end of each time step (13:182,184). In the solution for AFNEC, the terms for the continuous feed rate, $F_i$, and the continuous removal rate, $r_i$, are zero. The structural materials are a constant and are neither added nor removed during the operation of the reactor.

<u>ORIGEN2 Inputs.</u> The input into ORIGEN2 consists of three data bases, photon production, radioactive decay, and cross section. The decay data base is constructed from the *Table of Isotopes, 6th ed.*, by Lederer et. al. and contains the following information:

(1) the list of 1700 nuclides under consideration.
(2) the decay half-lives and decay branching fractions for beta decay to ground and excited states, positron/electron annihilation to ground and excited states, internal transitions, alpha decay, spontaneous fission, and delayed neutron decay.

(3) the isotopic compositions of naturally occurring elements.

Additionally, a user-constructed set of commands that define the program functions to be executed is required. (See Appendix B for a sample input command file.) Each part of the reactor facility is made of different materials and is in different regions of neutron flux. The mass and neutron flux that were used for these calculations were the same as those reported in the NUS report.

Activity Calculation. In calculation of the activity contained within the entombment, it is noted that many limitations are placed on the results. The assumptions used for limiting the calculations are as follows:

(1) The reactor operated at full power for 321 days.
(2) The upper bound of each element within the material composition was used.
(3) The cross section data for the elements only considered thermal neutrons.
(4) The neutron flux is constant throughout the material.

In assuming that the reactor is at full power for 321 days, the activation results give a somewhat biased answer. This is due to the short-lived radionuclides produced. If the 321 days are long enough for short-lived radionuclides to reach saturation, the production rate equals the decay rate and no increase in the population of short-lived radionuclides is seen. However, if the reactor is operated with a

varying schedule, the short-lived radionuclides will not reach saturation and therefore, will be at a lower activity than what is calculated. This limitation gives an overestimation of the initial radioactivity but disappears within 5 years after shutdown.

Using the upper value of structural elemental composition gives a total for each material that exceeds 100%. While this is an irritant, it will not affect the calculation of the activity of the material. Instead it will give an upper bound to the activity because the material will not have more of the reported element than is included within the calculation. Therefore, this is a minor limitation to the code and will cause an error on the safe side.

Aluminum type 5052 was investigated since it has a range of values for the composition of the elements magnesium and chromium. The ORIGEN2 computer code was ran using the various limits of these two elements. The limits will give an upper and lower bound for the activity in the component and then the effect of the composition range can be analyzed. The results of the computer runs for Al-5052 are given in Table 1. A thermal flux of $1.0*10^{13}\frac{n}{cm^2 sec}$ was chosen since the NUS report estimated this as the flux for the aluminum in the core tank.

The results of these calculations show a difference for the initial total activity when the amount of chromium in the material is changed while there is no change in magnesium.

This can be accounted for in the increase in chromium concentration. The initial activity of Cr-51 for the first two cases is $3232\frac{\mu Ci}{gm}$ while in the last two cases it is $7540\frac{\mu Ci}{gm}$. This is an increase of $4308\frac{\mu Ci}{gm}$ which is the difference in the initial activities. The difference in activities is negligible at later times after the material has had time to decay and plays no part in the total activity. The short half-life of Cr-51 is 27.7 days so the concentration would be decreased by 1000 times within 277 days and will not be considered in radioactive isotopic inventory at 20 years after shutdown.

Table 1. ORIGEN2 Results with Al-5052 compositions.

| ELEMENTAL WEIGHT (Percent) | | TOTAL ACTIVITY (uCi/gm) | | |
|---|---|---|---|---|
| Magnesium | Chromium | Initial | 20 yrs | 25 yrs |
| 2.20 | 0.15 | 1.387E6 | 1.729 | 0.4572 |
| 2.80 | 0.15 | 1.387E6 | 1.729 | 0.4572 |
| 2.20 | 0.35 | 1.392E6 | 1.729 | 0.4572 |
| 2.80 | 0.35 | 1.392E6 | 1.729 | 0.4572 |

Including only the thermal neutron cross sections for the activation calculations will cause the activity to be underestimated because the interactions of the elements with fast neutrons will not be considered. However, as was seen in the NUS report, the fast neutron fluxes are an order of magnitude lower than the thermal fluxes. Fast neutron cross

sections are less than cross sections for thermal neutrons. This aspect is seen in the NUS report, page 65, where it was concluded that the other reactions resulted in activities that were orders of magnitude lower.

The neutron fluxes used for the ORIGEN2 calculations were assumed to be the same throughout the material of interest. This will cause the calculated radioactivity inventory to be estimated on the safe side. The neutron flux will be attenuated as it traverses a material and the neutrons are removed as they interact with nuclides of the elements within the material. Figure 2 illustrates the attenuation of neutron flux for 4 materials used in AFNEC. As seen in the figure, the neutron flux is much lower as you traverse a material made of iron or cadmium with less than 20% of the flux remaining in iron and almost total removal of the flux when in cadmium. However, aluminum or lead do not attenuate the neutron flux as almost 90% of the flux remains after 10 centimeters.

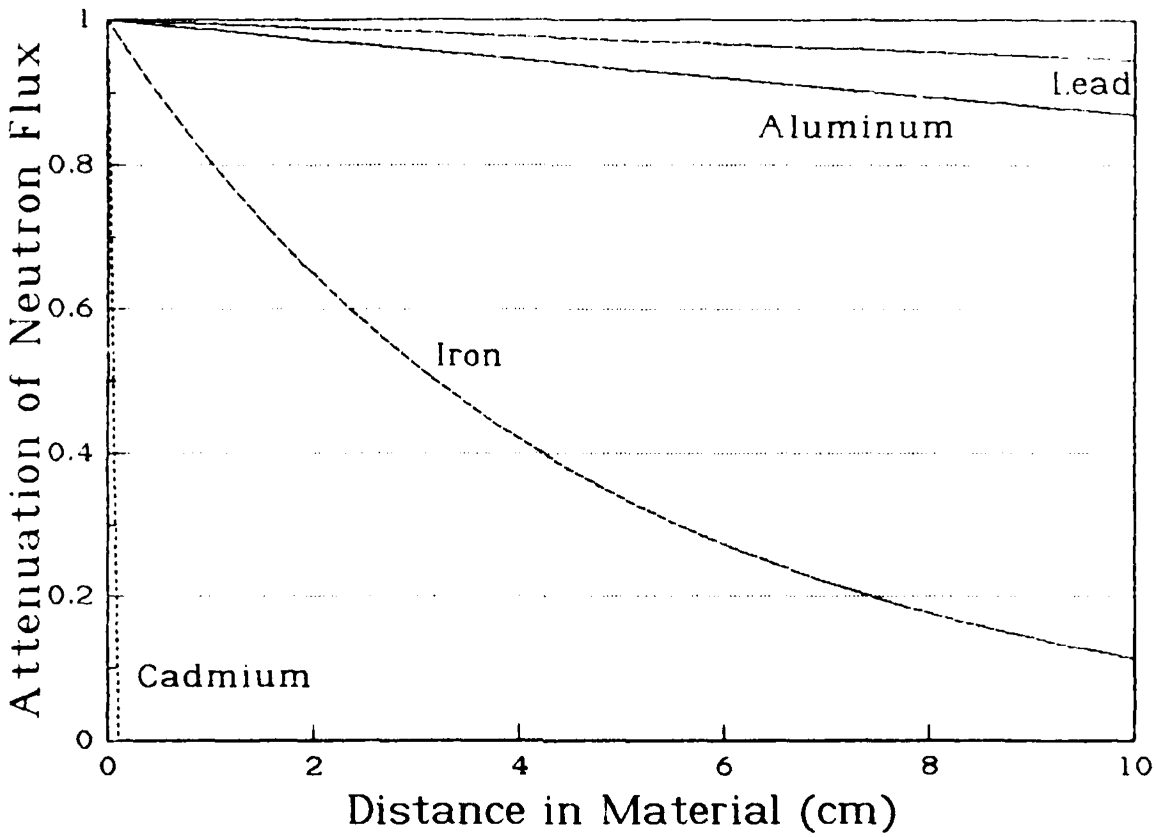


Figure 2. Thermal neutron flux attenuation $\left(\frac{\phi(x)}{\phi(0)}\right)$ in 4 pure materials using absorption cross sections.

## ORIGEN2 Results

The ORIGEN2 computer calculations of predicted total activity entombed within the concrete is given in table 2. Appendix C lists the individual results for each material part and the contribution of each individual radionuclide.

Table 2. Total Predicted Entombed Radioactivity in Curies

| Years since Shutdown | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 2430000 | 83800 | 31100 | 9900 | 1560 | 825 | 248 |

As is evident in figure 3, the activity is reduced by over two orders of magnitude within the first 10 years. Within that time, the majority of the short-lived radioisotopes have decayed.

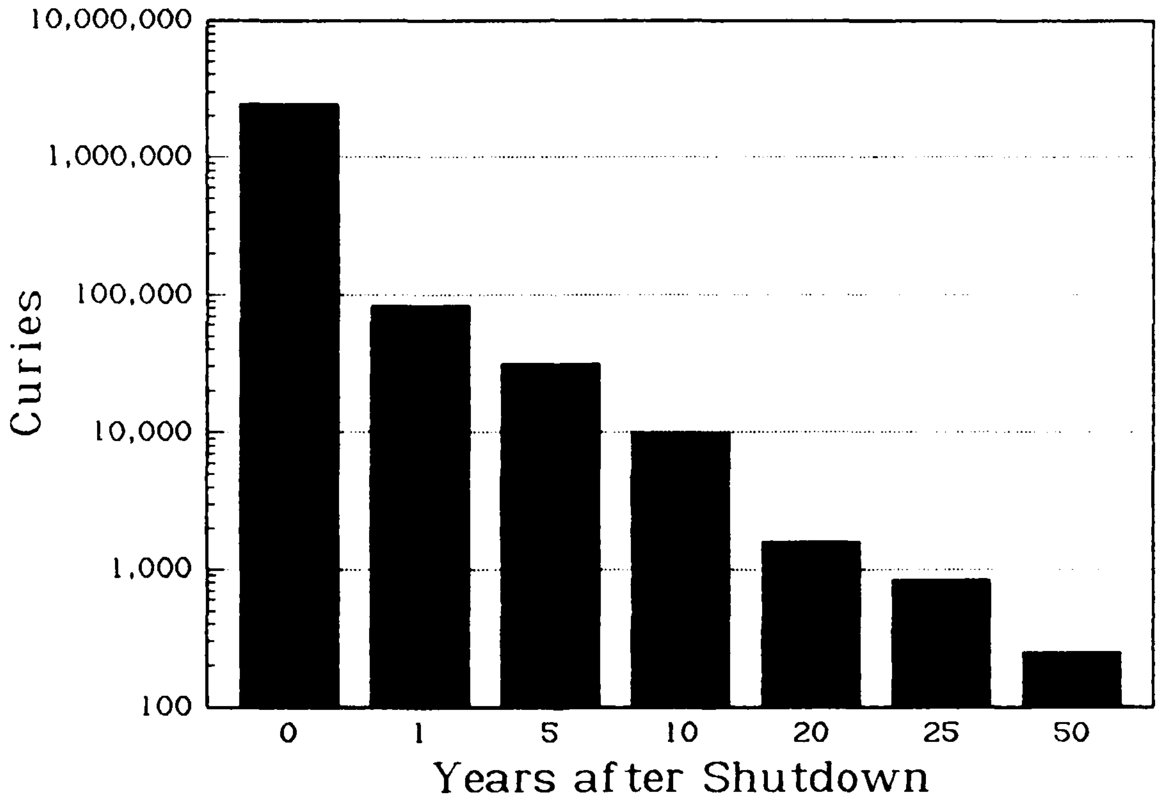


Figure 3. Total Predicted Radioactivity of Entombed Components

Fractional Component Activities. The individual material components contribute to the total activity with different intensities that change as time after shutdown increases. Table 3 displays the total activity of each structural component.

Table 3. Total Predicted Activity of Individual Components in Curies

| | Years since Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| Stainless Steel | 3.58 E5 | 15900 | 6850 | 2730 | 714 | 462 | 203 |
| Carbon Steel | 5.52 E5 | 66000 | 24000 | 7110 | 840 | 356 | 41.8 |
| Lead | 3.68 E4 | 205 | 6.62 | 3.13 | 2.91 | 2.83 | 2.47 |
| Concrete | 1.48 E4 | 395 | 35.1 | 14.3 | 3.85 | 2.34 | 0.369 |
| Aluminum | 1.43 E6 | 650 | 111 | 28.0 | 1.95 | 0.516 | 8.94 E-4 |
| Cadmium | 4.05 E4 | 691 | 70.8 | 5.98 | 1.27 | 1.20 | 1.04 |

Graphically it can be seen in figure 4 that the contribution of aluminum to the initial activity is nearly 60 %. However, 10 years later, the activity is less than half of one percent. Additionally, at 10 years and later, the majority of the activity is coming from the carbon and stainless steels, with stainless steel comprising 82% at fifty years

after shutdown. These changes in the activity contributions are attributed to the neutron activated materials within the components. The different activated components have differing half-lives and those with longer half-lives will survive to contribute a higher percentage of the total activity as the time after shutdown increases.

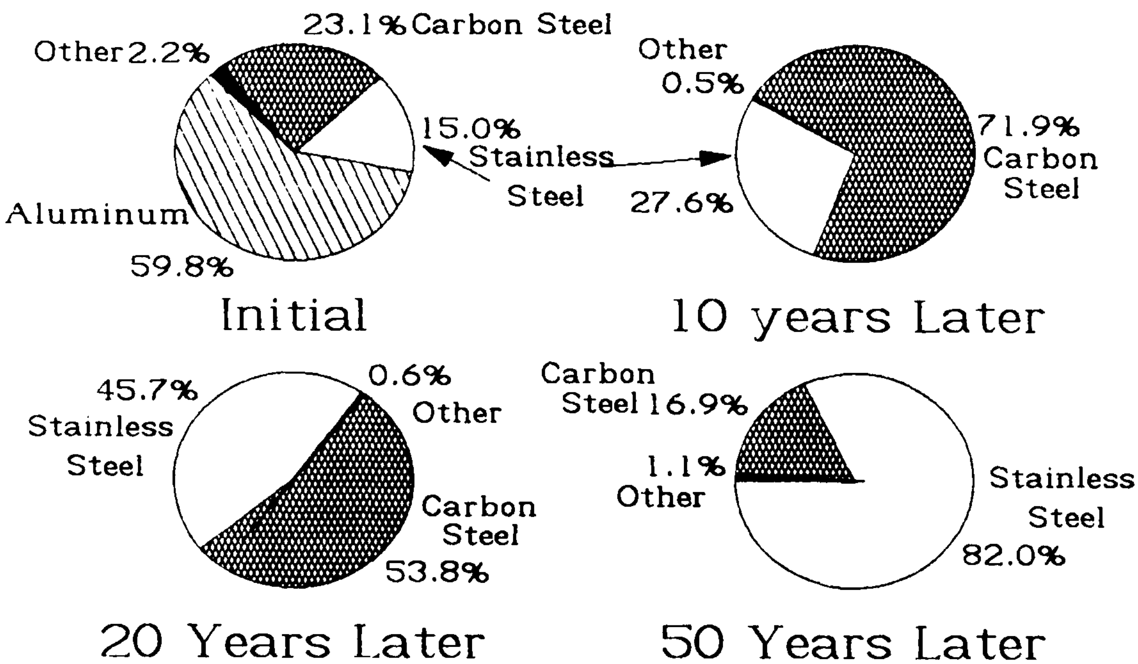


Figure 4. Predicted Percentage of Total Activity by Individual Components

Initially, aluminum, type Al-5052 contained within the core tank, had the highest activity. This is expected because the core tank was in the highest neutron flux region and the radionuclides that were produced had shorter half-lives than the other material components. Additionally, car-

bon and stainless steel contained in the test cell had the next highest contribution to the initial activity. Again, this was in a region of high neutron flux.

Fifty years after shutdown, the total activity from the reactor's structural materials will be almost exclusively from the carbon and stainless steels. Stainless steel begins to dominate because there is much more of it than there is of carbon steel and the different activated radionuclides. Again, it was seen that the most radioactive parts were in the area of the test cell because of the larger quantity of stainless steel and the longer half-lives.

Component Activities. Each individual component of the entombed monolith had specific parts at specified locations that contributed the majority of the activity of that material. Figure 5 displays the fractional activity of the materials contained within the monolith. (Appendix D contains the total activities of each individual component part grouped by materials.) It is noted here that the parts with the highest activity were within the regions of the highest flux. The activity percentage that is greatest is in the parts of materials contained within the test cell except for aluminum and concrete. The aluminum and concrete were located in specified areas and subjected to many different fluxes. The fraction of each part will remain the same as the materials decay because each part contains the same acti-

vated radionuclides.

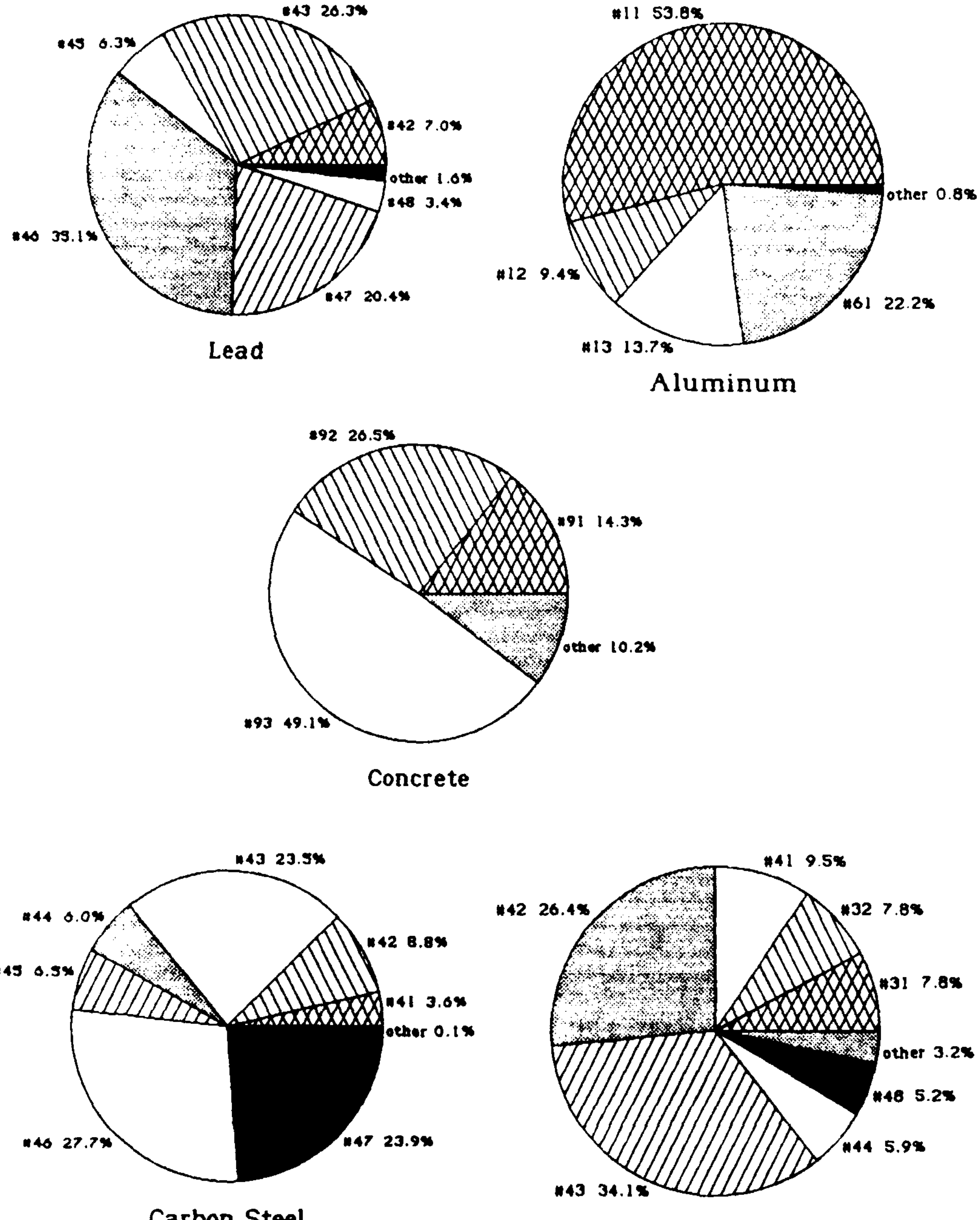


Figure 5. Predicted Activity Percentage of Individual Materials in the AFNEC. Note: The #'s represent the part numbers corresponding to Appendix D.

The radioisotopes of interest at 20 years after shutdown for each material is presented in table 4. As can be seen in figure 6, the dominant radioisotopes are Co-60, Fe-55, and Ni-63. The remaining radioisotopes contribute less than 4% of the total activity.

Table 4. The major radioisotopes from neutron activation of the structural materials at 20 years after shutdown.

| Component | Total Activity (Ci) | Radioisotopes |
|---|---|---|
| Carbon Steel | 840.00 | Ni-63, Ni-59, Co-60, Fe-55 |
| Stainless Steel | 714.00 | Ni-63, Ni-59, Co-60, Fe-55 |
| Concrete | 3.85 | Ba-133,Eu-152 |
| Lead | 2.91 | Ag-108m, Ag-108 |
| Aluminum | 1.95 | Ni-63, Co-60, Fe-55<br>Ag-108m, Ag-108 |
| Cadmium | 1.27 | Ag-108m, Ag-108 |

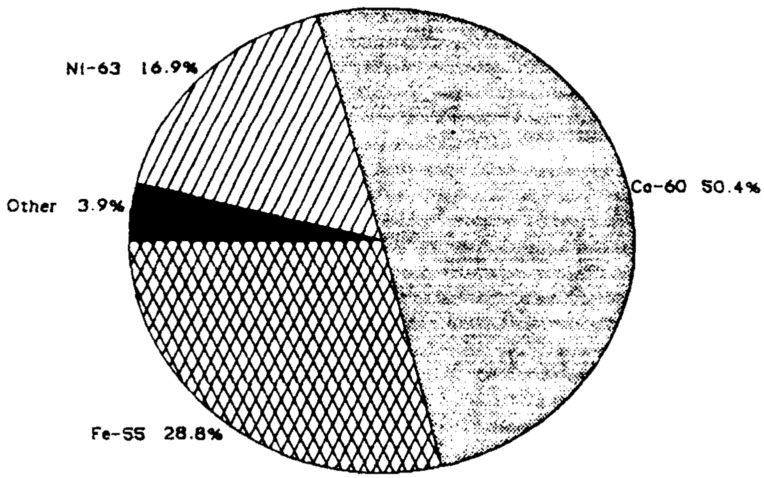


Figure 6. Predicted radioisotope activity percentage of total radioisotopic inventory within entombment at 20 years after shutdown.

## III. Component Integrity

An entombment of a nuclear reactor is the sealing of the most highly radioactive components within a massive concrete structure. The AFNEC entombment was completed in June, 1971 (12:3), and the entombed reactor was to remain in that state for over one hundred forty years. The activity, by that time, would be decayed to a much lower radioactivity level, and consequently, lower protection will be required for workers dismantling the facility. In order for the facility to survive for that time period, it is important that a determination of the component integrity be studied. This section presents the current information available concerning the integrity of the components of the AFNEC.

Many materials make up the structure of the AFNEC at WPAFB. Appendix B lists the elements of each structural component and individual parts used in the radioactive calculations. While each component is made up of many different elements, the component itself will act as the major element when considering the integrity. These structural components have certain designed lifetimes that are important when they are being used for an extension of its useful life. The materials of interest in this entombment are the structural metals and concrete used as the biological shield. If these materials are susceptible to deterioration, then it is important to identify problems that could develop immediately and

take corrective action. However, if the integrity of the materials will not be breached, then the structure will not be a radiological hazard to individuals in the area and no corrective action will be required.

Metals

Corrosion is the destructive attack of a metal by a chemical or electrochemical reaction with its environment. Corrosion damage can also occur by other methods and cause failure of the metal by cracking or loss of ductility and strength (16:1). Any corrosion damage of interest in the AFNEC is the failure of the material, which could result in the release of radioactive nuclides. Therefore, rusting or corrosion cracking of the metal are the failure mechanisms of main concern. Four types of corrosion are possible in metals.

The first type of corrosion is uniform attack of the metal. This process is averaged over the surface of the metal and is termed as *inches penetration per year (ipy)* or *milligrams per square decimeter per day (mdd)*. The duration of exposure is reported with these units to give an indication to the severity of the deterioration. This is because extrapolation is not a good indicator of the corrosion of a metal (16:13).

Second, pitting corrosion is another important failure mechanism of metal. Localized attack of the metal is at a

higher rate than uniform attack. As a result, this creates a weak spot in the material, and therefore, failure of the structure is likely to occur at the location of the pitting. Metal-oxide deposits usually fill the pits so corrosion is not noticed until the material is cleaned (16:14).

Third is intergranular corrosion. This is the localized attack of the grain boundaries of the metal. Primarily this results in the loss of strength and ductility (16:15). However, this is not of concern for the entombed reactor, since the structure is not under stress.

Fourth, cracking corrosion occurs from repeated tensile stress in a corrosive environment. The combination of the stress and corrosion of the metal results in a decrease of the metal's strength. In the absence of a corrosive environment, this failure would be described as metal fatigue (16:16). Since the entombment is not under any stress, this type of corrosion is not likely to occur.

Different metal materials were used in the AFNEC. Because of the varying degree of deterioration due to possible corrosion of metals, each metal will be presented separately. Lead, cadmium, aluminum, stainless steel, and carbon steel were all used throughout the reactor (3:82-86). However, only lead, aluminum, stainless steel, and carbon steel are of interest, since these metals contain over 99% of the entombed radioactivity, as seen in figure 4.

Lead (16:351-352). Lead is passive in many corrosive environments and as a result has a low corrosion rate. The corrosion resistance is due to the production of protective films on the surface. Lead is corroded by alkalies at moderate or high rates, depending upon the temperature and concentration surrounding it. Lead is also resistant to corrosion that would occur from contact with freshwater or seawater. The rate of corrosion is dependent upon the amount of oxygen dissolved in the water with which it has contact. Lead has a high coefficient of expansion ( $\frac{30E-6}{^\circ C}$ ) which leads to intergranular cracking by fatigue in the presence of thermal cycling.

Lead was used in the test cell and the beam tube plugs of the AFNEC. Therefore, intergranular cracking by fatigue is of little concern, because the structural parts are inside the entombment and not subjected to thermal cycling. Within the entombment, lead is in contact with concrete and not subjected to an aqueous environment.

Aluminum: Al-5050, Al-5052, Al-6061 (16:334-347). Aluminum has good corrosion resistance to the atmosphere and many aqueous environments. Additionally, it has good electrical and thermal conductivity, but becomes passive on exposure to water. Water containing chloride ions tend to cause aluminum to pit. Water with traces of copper ions or iron ions also causes aluminum to react, and deposits metal-

lic copper or iron on surrounding sites. These sites in turn shift the corrosion potential and stimulate pit growth.

Aluminum type 6061-T corroded at decreasing rates with time when immersed in Panamanian seawater. A 16-year exposure to the seawater resulted in a total weight loss of 630*mdd*. In fresh water at the same site, a higher weight loss of 1030*mdd* was seen. This is evidence that the composition of the water in which the material is immersed is an important factor.

Aluminum was used in the core tank, thermal column tank, BSF tank, and the beam tubes. Aluminum had the highest initial activity of any material in the reactor. However, at fifty years it will have the lowest activity contribution to the total entombed radioactivity.

Stainless Steel: SS-304 (16:294-321). Stainless steel components that have been neutron activated are the largest portion of the total activity remaining in the containment. Therefore, it is crucial that the degradation of this material component be investigated when considering the stability of the entombment.

Stainless steel, type SS-304, is an austenitic steel. Austenitic steel has a face-centered cubic crystal structure, is nonmagnetic, and is readily deformed. The steel is hardened by cold working, but not by heat treating. Corrosion of the austenitic steel is in the form of intergranular

corrosion, and comes about as a result of specific impurities in the alloy. The chemical environment is the major factor in determining the corrosion rates.

Stainless steel is passive and can be coupled to other metals that are passive or noble on the electrochemical potential scale. In general they are resistant to acids, alkalies, and the atmosphere. Type SS-304 has been used for auto trim and as architectural trim. As this material is encased within a concrete monolith, no deterioration of this material is expected.

In the AFNEC entombment, the stainless steel is encased within concrete and therefore not subject to chemical attack of the intergranular structure.

Carbon Steel: ASTM-212, ASTM-7 (16:96-126). Carbon steel components of the entombed reactor contain the largest percentage of radioactivity during the current time period, 10 to 20 years after shutdown, as seen in figure 4. Therefore, it is important that this material remain intact and not be breached and release radioactivity.

Carbon steel contains a higher percentage of iron within the alloy than does stainless steel. This causes the material to become more susceptible to corrosion than stainless steel. Iron reacts with oxygen and water to produce hydrous ferric oxide which is the orange to red brown rust we commonly associate with ordinary rust. Initially clean iron

reacts to form the oxide film on the surface of the metal. However, after the initial surface film has been produced, the corrosion rate will slow down as the sites of electrochemical reactions are covered.

Corrosion of iron is affected by the type of environment in which it is immersed. Within an aqueous environment, it has been seen that an initial corrosion rate of 100 *mdd* is diminished over time to a rate of 10 *to* 25 *mdd* with the higher rate in moving water. Additionally temperature affects the corrosion rate of iron. The corrosion rate will increase with higher temperatures by approximately double for each $30°C$ rise in temperature. The pH of the water has little effect until a very low (about pH of 3) or a very high (about pH of 11) pH is seen.

Within the AFNEC facility, the possibility of corrosion of the carbon steels is slight because they are entombed within the poured concrete. This will not allow the intrusion of water and let the material corrode.

## Concrete

Concrete degradation is an important aspect in the study of component integrity of the AFNEC entombment. Therefore, the history of performance of concrete components will be addressed along with specific applications to the AFNEC entombment.

The most extensive information documented concerning concrete component conditions has been done at the Savannah River Plant which has three reactors operating for over 25 years. The reactor buildings have been inspected and found suitable for continuing operation. Minor cracking of concrete in the containment shell was found but continued operation of the reactors occur as consultants have reviewed the data and deemed it safe (9:35).

Concrete deterioration mechanisms that can cause early failure are:

(1) Freezing and thawing.
(2) Aggressive chemical attack.
(3) Abrasion.
(4) Corrosion of steel and embedded materials.
(5) Chemical reactions of aggregates.
(6) Unsound cement or shrinkage.

There are four possible causes of these six failure mechanisms. The four causes are; cracking, abrasive environment, embedment corrosion, and extreme environmental exposure (9:48).

Cracking (9:52-53). Cracking of concrete is classified by the time of occurrence. Cracking of concrete during initial setting results from a number of causes ranging from poor form construction to insufficient expansion or control joints. Most concrete cracking has the form of plastic shrinkage cracking, settlement cracking, and crazing. Plastic shrinkage cracking is caused by the rapid loss of surface moisture and cracks are formed by the differential volume

changes. Settlement cracking occurs from improperly prepared concrete forms and as the concrete dries it pulls apart. Crazing is a surface effect from excessive troweling or excessive water loss. This is not a threat to the AFNEC structure since proper construction procedures did not result in any initial problems.

Hardened concrete cracking results from thermal effects, chemical reactions, and shrinkage with restraint. If the concrete is subjected to temperature changes (usually greater than 40°C), uneven expansion and contraction of the concrete will place stress on the concrete and eventually cause cracks. Chemical reactions occur from chemical interactions of the aggregate. The chemical reactions cause uneven expansions and the concrete cracks. Shrinkage with restraint occurs during the drying of hardened concrete. When moisture dries from the concrete, it will shrink, and if the tensile limit of the concrete is reached, the concrete will crack. Of these three methods of cracking, only shrinkage with restraint is of concern for the AFNEC entombment and then only of concern if water is allowed into the entombment.

Aggressive Environments (9:54-55). Aggressive environments that could cause concrete deterioration come in the form of weathering, leaching and effervescence, and chemicals. Weathering will cause the concrete to deteriorate by cyclic methods. The temperature changes causing freezing

and thawing results in water within the concrete to producing hydraulic pressures that exceed the tensile strength and cause cracking. Additionally, the wetting and drying also cause the pressure to exceed the tensile strength which in turn causes the material to fail. Leaching and effervescence are phenomenon that effect the concrete at different locations. Leaching is the process by which water flowing out of the concrete carries soluble elements with it. Efflorescence is a surface phenomena in which salts are crystallized with the evaporation of water. While this is only a surface effect, it is important since it usually indicates leaching is taking place. Chemicals in the concrete environment can cause deterioration by attacking components within the concrete. Acidic solutions and materials attack more readily since most components within the concrete are alkaline.

Of the previous environmental concerns, leaching is of most importance. Radioactive nuclides contained within the concrete could be released to the environment by leaching out. Leaching occurs when a soluble radionuclide is picked up by the water passing through the concrete and then passing out of the entombment, thereby releasing the radionuclide. While this is unlikely to happen it should be of concern when any decision concerning the continuation of entombment is made.

Embedded Corrosion (9:55). Embedded corrosion is the corrosion of embedded materials, primarily reinforcing steel. When corrosion of this type occurs, the concrete is subjected to tensile forces from the rust formation and will fail as a result. The previous section discussed the corrosion of metals entombed within AFNEC and no further discussion will be done as it is assumed the concrete is not submerged within water and therefore, the reinforcing steel will not deteriorate.

Extreme Environmental Exposure (9:55-58). Environmental exposure to extremes that concern concrete are prolonged exposure to elevated temperatures and irradiation. Elevated temperature and thermal gradients within the concrete structure are the result of changes in moisture content. The barytes concrete entombed within the AFNEC has not been subjected to operating temperatures since the reactor was shutdown and therefore discussion of extreme elevated temperature effects will not be done. The effect of radiation on concrete is difficult to generalize as many variables were involved when studies concerning radiation were conducted.

## IV. Land Use Options

The entombment of the Air Force Nuclear Engineering center was completed in June of 1971. At that time, it was decided that the structure would remain in the entombed state for over 140 years. At termination of the entombment, another study would be done to determine if the radioactive components had decayed to acceptable levels to permit the dismantlement of the concrete monolith. Once dismantled, the land would be restored to unrestricted access and could be used for any other purpose. While the present status is under consideration, it is feasible to determine what options are available at the present time with regards to the present disposition of the entombment. The two possible alternatives investigated here deal with dismantling the monolith or the continued surveillance mode.

### Dismantling

The four-option study done by Martin-Marietta had as one of the options, the option to raze all structures and restore the site to allow unrestricted access. This is the total removal and disposal of all radioactive components. Within the described tasks of the report, the work of removal of the ancillary buildings is also included which does not strictly involve radioactive components but does include, within the support buildings, asbestos; an identified hazardous mate-

rial. Additionally, the underground portions are removed and the area backfilled to bring the area back to its original state (4:86-92).

The 1987 cost estimate reported in the Martin-Marietta study stated an amount of $42.2 million would be needed to implement the work. A 1978 decommissioning cost estimate for a reference boiling water reactor (BWR) states for immediate dismantlement the cost would be $43.6 million (17:2-14). Assuming an escalation factor of 5% per year, in 1987 dollars, this would cost in the neighborhood of $67.6 million. It should be noted here that immediate dismantling of a reactor would not involve the removal of added concrete that was required to place the facility in entombment status. As seen earlier in this report, the total activity within the structural materials has decayed by three orders of magnitude so protection requirements are lowered. Additionally, AFNEC has had the fuel elements removed from the facility and disposed of when the facility was entombed. The cost estimate for the total razing of option four of the Martin-Marietta is therefore within reason.

Continued Surveillance

The AFNEC facility was scheduled to remain in the surveillance mode for 140 years until well into the next century. At that time, the activity levels would be lowered and dismantlement of the entombment could be done with lower

protection requirements. To provide for the continuing care of the facility, a maintenance and surveillance program was implemented in 1971 at the completion of the entombment. According to the Martin-Marietta report, the ventilation and air conditioning within the containment were reduced and moisture condensed within the facility. This in turn led to degradation of the structure as some corrosion was identified (4:7). The report did give an estimate of $1.0 million to bring the facility up to current standards that would allow the entombment to continue in the continued surveillance mode (4:D-1;D-4).

Certain fixed costs are associated with the facility when it is in the caretaker status. These costs cover such items as radiological surveillance of the facility and the surrounding area, maintenance of the building to ensure deterioration of the structure is not occurring, and the physical plant operation to insure the environment is controlled. Using Martin-Marietta's estimate of $530,000 (1987 dollars) and an escalation factor of 5%, it can be seen that within 50 years the cost of maintaining the facility has reached what it would cost for the immediate dismantlement of the structure (4:11). The 1978 cost estimate for the reference BWR gives an annual figure of $40,000 per year (17:2-14). Incorporate the 5% escalation factor and in 1987 dollars, the annual surveillance becomes $62,000 per year. This is a dramatic difference from the Martin-Marietta report. The dif-

ference can be attributed to Martin-Marietta's calculation of the costs using an outside firm to do the required maintenance and surveillance. Since these tasks would not require full time individuals, it would appear that the annual cost would be substantially lower.

## V. Conclusions and Recommendations

The previous sections of this report gave neutron activation results for the entombment, component integrity discussions, and cost comparisons. These three items are important when reaching a decision on the further action for the AFNEC facility.

### Neutron Activation Calculations

The ORIGEN2 computer calculation results for the AFNEC facility produced results higher than was calculated by the original NUS report. The difference can be attributed to the inclusion of all the nuclides contained within the material when the calculation was done. ORIGEN2, a more complex computer code, gives results that are based on the input to the code. The material composition used for inputs into the code were biased as the highest value for each element was used. A better calculation can be done if the exact elemental composition is determined from the samples of the structures that have been removed. Another improvement to the calculations can be done by changing the input to the ORIGEN2 code so it would reflect the nuclear reactors operating schedule.

## Component Integrity

The structural components entombed within the concrete monolith have a very stable environment and appear likely to survive well past the designed entombed lifetime. This is evidenced by the previous work investigating the life extension of nuclear power plants and corrosion studies done on the metals entombed within the structure.

## Land Use Options

The cost estimates for the complete razing of the structure given by Martin-Marietta is within the expected cost of dismantling a reactor. However, the annual costs appear on the high side because of the use of an outside contractor for the work.

## Recommendations

The following recommendations are given for future work in analyzing the entombed radioactivity and structural integrity.

(1) A complete breakdown of the elemental composition of the materials used within the structural members is required for a more precise ORIGEN2 computer output.
(2) An operating schedule of the reactor for input into the code will reduce the short-lived radionuclides at reactor shutdown and improve the initial estimate.
(3) Determine the flux attenuation through each of the structural parts to get a better estimate of the total activation and hence a better predicted radioactivity inventory estimate.

## Appendix A: Material Compositions

The materials used within the AFNEC facility had a range of elemental compositions. The elemental compostion of each material is presented in table A-1. Table A-2 lists the location and size of the component parts within the entombed structure that were subjected to the neutron activation flux.

Table A-1. Percentage Composition of Materials

| Element | Carbon Steel | | Aluminum | | |
|---|---|---|---|---|---|
| Atomic Number | ASTM A-212 | ASTM A-7 | Al-6061 | Al-5050 | Al-5052 |
| Al-13 | 0.05 | | 96.0 | 97.5 | 96.1 |
| Fe-26 | 97.0 | 98.5 | 0.70 | 0.40 | 0.45 |
| Si-14 | 0.1 - 0.25 | 0.10 | 0.4 - 0.8 | 0.40 | 0.45 |
| Ag-47 | | | 1.47 E-7 | 1.47 E-7 | 1.47 E-7 |
| Cd-48 | | | | | |
| Cu-29 | 0.50 | | 0.15 - 0.4 | 0.20 | 0.10 |
| Mn-25 | 0.90 | 1.00 | 0.15 | 0.10 | 0.10 |
| Mg-12 | | | 0.8 - 1.2 | 1.0 - 1.8 | 2.2 - 2.8 |
| Cr-24 | 0.50 | 0.005 | 0.15 - 0.35 | 0.10 | 0.15 - 0.35 |
| Zn-30 | | | 0.25 | 0.25 | 0.10 |
| Ti-22 | | | 0.15 | | |
| C-6 | 0.30 | | | | |
| P-15 | 0.05 | 0.05 | | | |
| S-16 | 0.06 | 0.06 | | | |
| Ni-28 | 0.50 | 0.10 | | | |
| Co-27 | 0.05 | 0.01 | 4.17 E-7 | 4.17 E-7 | 4.17 E-7 |
| N-7 | 0.15 | | | | |

Table A-1 Percentage Composition of Materials (Continued)

| Element /Atomic Number | Stainless Steel SS-304 | Cadmium | Lead | Barytes Concrete |
|---|---|---|---|---|
| Al-13 | | | | 0.40 |
| Fe-26 | 69.8 | 0.05 | | 4.50 |
| Si-14 | 1.00 | | | 1.02 |
| Ag-47 | | 0.10 | 0.02 | |
| Cd-48 | | 99.5 | | |
| Cu-29 | | 0.05 | 0.08 | |
| Mn-25 | 2.00 | | | |
| Mg-12 | | | | 0.11 |
| Cr-24 | 18 - 20 | | | |
| Zn-30 | | 0.05 | 1.50 E-3 | 8.35 E-3 |
| Ti-22 | | 0.05 | | |
| C-6 | 0.08 | | | |
| P-15 | 0.045 | | | |
| S-16 | 0.03 | | | 10.4 |
| Ni-28 | 8 - 12 | | | |
| Co-27 | 0.20 | | | 9.42 E-3 |
| Bi-83 | | | 0.05 | |
| Sb-51 | | | 0.015 | |
| Sn-50 | | | 0.015 | |
| Pb-82 | | 0.20 | 99.9 | |
| H-1 | | | | 0.70 |
| O-8 | | | | 33.0 |
| Ca-20 | | | | 4.86 |
| Ba-56 | | | | 48.9 |
| Eu-63 | | | | 2.31 E-5 |
| Ir-77 | | | | 0.16 |
| Li-3 | | | | 1.46 E-5 |

Table A-2. Materials of Construction

| Weight | | | Volume | |
|---|---|---|---|---|
| Region/No./Part | Approximate Size | Material | (cu in) | (lbs) |
| A Core Tank | | | | |
| 11/Core Tank | 27 5/8" * 16 1/2" * 87 1/2" | Al-5052 | 13147 | 1220 |
| 12/Lower Grid | 27 1/2" * 15" * 3" | Al-6061 | 345 | 32 |
| 13/Thermal Neutron Curtain | 27" * 56" * 1/2" - 2 each | Al-6061 | 1540 | 143 |
| 14/Cadmium Curtain | 27" * 56" * 1/8" - 2 each | Cadmium | 378 | 118 |
| B Lower Tank | | | | |
| 21/Upper Flange | 22" * 33" * 1 3/4" | SS-304 | 492 | 140 |
| 22/20 cm Near Core | 27 5/8" * 16 1/2" * 8" | SS-304 | 460 | 130 |
| 23/Next 25 cm | 27 5/8" * 16 1/2" * 10" | SS-304 | 952 | 270 |
| 24/Remainder | 27 5/8" * 16 1/2" * 44 1/2" | SS-304 | 3380 | 959 |
| C Upper Tank | | | | |
| 31/Support Ring | 60" diameter * 3" | SS-304 | 6048 | 1715 |
| 32/Bottom | 60" diameter * 3" | SS-304 | 6048 | 1715 |
| 33/Lower Section | 120° * 4" * 30" radius | SS-304 | 240 | 68 |
| 34/Remainder | 26'9 3/4" * 60" dia * 3/8" | SS-304 | 6048 | 1715 |
| 35/Liner | 27' * 65" dia * 3/8" | ASTMA-7 | 6160 | 1675 |
| D Test Cell | 11' * 6'2" * 7'8 1/2" | | | |
| 41/Window Frame | 11' * 6'2" * 7'8 1/2" | ASTMA-212 | 1433 | 406 |
| | | SS-304 | 927 | 263 |
| | | Lead | 96 | 39 |
| 42/Core Walls | 2'10" * 6'2" * 5" | ASTMA-212 | 4699 | 1333 |
| | | SS-304 | 3435 | 974 |
| | | Lead | 3350 | 1373 |
| 43/Wing Walls | 24" * 6'2" * 5" | ASTMA-212 | 15622 | 4430 |
| | | SS-304 | 5541 | 1571 |
| | | Lead | 15683 | 6425 |
| 44/Wing Ceiling | 28" * 6'2" * 5" | ASTMA-212 | 4809 | 1364 |
| | | SS-304 | 305 | 87 |
| | | Lead | 970 | 397 |
| 45/Wing Floor | 28" * 6'2" * 5" | ASTMA-212 | 5174 | 1467 |
| | | SS-304 | 322 | 91 |
| | | Lead | 4459 | 1827 |

Table A-2. Materials of Construction (Continued)

| Weight | | | Volume | |
|---|---|---|---|---|
| Region/No./Part | Approximate Size | Material | (cu in) | (lbs) |
| 46/Next half of remainder | 4'4" * 6'2" * 7'8 1/2" | ASTMA-212 | 43961 | 12483 |
| | | SS-304 | 4186 | 1187 |
| | | Lead | 49978 | 20476 |
| 47/Last half of remainder | 4'4" * 6'2" * 7'8 1/2" | ASTMA-212 | 95197 | 26998 |
| | | SS-304 | 5803 | 1646 |
| | | Lead | 72862 | 29852 |
| 48/Door | 6'2" * 6'7" * 7'8" - 2 ea. | ASTMA-212 | 50420 | 14299 |
| | | SS-304 | 5040 | 1430 |
| | | Lead | 24000 | 9832 |
| 49/Lead Above the Thermal Column Tank | 38" * 15" * 12" | Lead | 8879 | 3638 |
| E Thermal Column Tank | 64 1/2" * 50 1/2" * 54" | | | |
| 51/Front Face | 24 3/4" * 48 3/4" * 3/8" | Al-5052 | 454 | 45 |
| 52/Wings - 2 each | 17 1/2" * 48 3/4" * 3/8" | Al-5052 | 74 | 7 |
| 53/Wing top&bottom | 26" * 51" * 3/8" - 2 each | Al-5052 | 670 | 61 |
| 54/2nd Panel | 36" * 48" * 3/8" O.D. 30" * 43" I.D. | Al-5052 | 67 | 6 |
| 55/Remainder | 53" * 50 1/2" * 54" | Al-5052 | 39474 | 3647 |
| 56/Upper & Lower Plenum Plate | 26" * 51" * 3/8" | SS-304 | 1691 | 475 |
| 57/"I" Beam | 3" * 4.8' (1.96 lb/ft) | Al-6061 | 102 | 9 |
| 58/HBT - Extensions | (51") | Al-6061 | 748 | 69 |
| 59/HBT - Extensions | (2nd half) | Al-6061 | 475 | 44 |
| F BSF Tank | | | | |
| 61/Window Plate | 74" * 49" * 3/8" | Al-5050 | 5348 | 494 |
| & Ribs | | Al-5050 | 5368 | |
| 62/Face | 15' * 12" * 1/4" | | | 496 |
| 63/Remainder | ---- | ---- | --- | --- |
| G Beam Tubes HBT 1/2/3/4 | | | | |
| 71/Beam Tube 1&2 (1st third) | 51" * 12" O.D. * 3/8" wall | SS-304 | 1397 | 396 |
| 72/Beam Tube 1&2 (2nd third) | 37" * 8" O.D. * 1/4" wall | SS-304 | 450 | 128 |
| 73/Beam Tube 3&4 (1st third) | 51" * 12" O.D. * 3/8" wall | SS-304 | 1397 | 396 |
| 74/Beam Tube 3&4 (2nd third) | 40" * 8" O.D. * 1/4" wall | SS-304 | 487 | 138 |
| 75/Beam Tube 1&2 (last third) | 20" * 8" O.D. * 1/4" wall | SS-304 | 243 | 69 |

Table A-2. Materials of Construction (Continued)

| Region/No./Part | Approximate Size | Material | Volume (cu in) | Weight (lbs) |
|---|---|---|---|---|
| H Beam Tube Plugs (4) | | | | |
| 80/Rear half | 40" * 7.5" diameter | Al-6061 | 1827 | 169 |
| | | Lead | 92 | 38 |
| 81/Front half | 48" * 12 1/4" diameter | Al-6061 | 2439 | 225 |
| I Biological Shield | | | | |
| 90/Lower Tank Annulus | 60" I.D., 72" O.D. * 28" | Conc. | 34800 | 4350 |
| 91/1st Partial Upper Tank Annulus | 64" I.D., 76 1/2" O.D. * 14" 208 degree arc | Conc. | 11200 | 1400 |
| 92/2nd Partial Upper Tank Annulus | 76 1/2" I.D., 89" O.D. * 6 1/4" 208 degree arc | Conc. | 5870 | 734 |
| 93/1st third of Beam Tube 1&2 walls | 8" I.D. * 20.5" O.D. * 24" - 2 each | Conc. | 13400 | 1680 |
| 94/2nd third of Beam Tube 1&2 and 1st half of Beam Tube 3&4 walls and 1st half of Beam Plugs | 20.5" O.D. * 12" * 4' | Conc. | 17200 | 2150 |
| 95/Thermal Column Walls | 20" * 70" * 6 1/4" - 2 each | Conc. | 17500 | 2190 |
| 96/Thermal Column Wing Bottom | 10 1/2" * 10 1/2" * 24" - 2 each | Conc. | 5290 | 661 |
| 97/Thermal Column Ceiling & Floor | 50" * 20" * 6 1/4" - 2 each | Conc. | 12500 | 1560 |
| 98/Test Cells North Walls | 60" * 98" * 6 1/4" - 2 each | Conc. | 73500 | 9190 |
| 99/Test Cells Ceilings | 78" * 64" * 6 1/4" - 2 each | Conc. | 52900 | 6610 |
| 100/Test Cells | 78" * 55" * 6 1/4" - 2 each | Conc. | 53600 | 6700 |

## Appendix B: ORIGEN2 Computer Code Input

The ORIGEN2 Isotope Generation and Depletion computer code was applied to the Air Force Nuclear Engineering Center 1Ø $MW_{th}$ reactor which was shutdown in June 197Ø. The computer code calculated the activation of elements contained in different materials with the appropriate input data. With this information, ORIGEN2 calculated the activity for any times requested by the input file.

The basis for the computer calculations was an operation time of 321 days. The various materials contained within the reactor facility and the various neutron fluxes were used as inputs to give the results.

The following example input file is for part #11/Al-5Ø52.

```
-1
-1
-1
BAS   #11    CORE TANK IRRADIATION
LIP   Ø   Ø   Ø
LIB   Ø   1   2   3   2Ø1   2Ø2   2Ø3   9   3   Ø   1   1
PHO   Ø   Ø   Ø   1Ø
RDA   READ AL-5Ø52 COMPOSITION (1ØØ.Ø GM)
INP   -3   1   -1   -1   1   1
TIT     * IRRADIATION OF AL 5Ø52 *
MOV   -3   1   Ø   1.ØE4
IRF    3Ø   1.ØE13    1    2   4   2
IRF    6Ø   1.ØE13    2    3   4   Ø
IRF    9Ø   1.ØE13    3    4   4   Ø
IRF   12Ø   1.ØE13    4    5   4   Ø
IRF   15Ø   1.ØE13    5    6   4   Ø
IRF   321   1.ØE13    6    7   4   Ø
TIT      *  Decay of Al  5Ø52   *
MOV   7   1   Ø   1.Ø
DEC    1.Ø   1   2   5   4
DEC    5.Ø   2   3   5   Ø
DEC   1Ø.Ø   3   4   5   Ø
DEC   2Ø.Ø   4   5   5   Ø
DEC   25.Ø   5   6   5   Ø
DEC   5Ø.Ø   6   7   5   Ø
```

```
OPTL  8 8 8 8 8 8 1 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTA  8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF  8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OUT  7  1  -1  Ø
END
4   130000  96.1   260000  Ø.45   140000  Ø.45   470000
1.47E-7  Al5Ø52
4   290000  Ø.10   250000  Ø.10   120000  2.80   240000
Ø.35     Al5Ø52
4   300000  Ø.10   270000  4.17E-7  Ø  Ø.Ø
Al5Ø52
Ø
```

## Appendix C: ORIGEN2 Results

The following tables list the ORIGEN2 output by material and part number which corresponds to Appendix A. If a radionuclide's predicted activity is above the cutoff fraction of $10^{-25} \frac{\mu Ci}{gm}$ at ten years it is included within the list. The cutoff of ten years was used since the time since shutdown of the reactor is approaching 20 years and radionuclides with short half-lives or of little activity is of little interest because other radionuclides overwhelm. However, the totals contain the inputs from all radionuclides even though they are not displayed.

Al 5052 Specific Activity (µCi/gm)

Part: #11 Weight: 5.53E+05 gms Flux: 1.00E+13 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| | Years after shutdown | | | | | | |
| SI 32 | 5.29E-09 | 5.29E-09 | 5.26E-09 | 5.24E-09 | 5.18E-09 | 5.15E-09 | 5.02E-09 |
| P 32 | 4.32E-03 | 5.38E-09 | 5.26E-09 | 5.24E-09 | 5.18E-09 | 5.15E-09 | 5.02E-09 |
| FE 55 | 3.58E+02 | 2.74E+02 | 9.43E+01 | 2.49E+01 | 1.73E+00 | 4.56E-01 | 5.86E-04 |
| FE 59 | 4.36E+01 | 1.57E-01 | 2.64E-11 | 1.60E-23 | | | |
| CO 60 | 6.31E-02 | 5.53E-02 | 3.27E-02 | 1.69E-02 | 4.54E-03 | 2.35E-03 | 8.78E-05 |
| NI 63 | 9.32E-05 | 9.24E-05 | 8.97E-05 | 8.64E-05 | 8.01E-05 | 7.72E-05 | 6.39E-05 |
| ZN 65 | 5.64E+02 | 2.00E+02 | 3.14E+00 | 1.75E-02 | 5.42E-07 | 3.02E-09 | 1.62E-20 |
| AG108 | 3.89E-02 | 1.45E-06 | 1.42E-06 | 1.38E-06 | 1.31E-06 | 1.27E-06 | 1.11E-06 |
| AG108M | 1.64E-05 | 1.63E-05 | 1.60E-05 | 1.55E-05 | 1.47E-05 | 1.43E-05 | 1.25E-05 |
| AG109M | 5.40E-06 | 1.32E-06 | 1.48E-07 | 9.70E-09 | 4.14E-11 | 2.70E-12 | 3.22E-18 |
| AG110 | 9.26E-02 | 1.32E-05 | 2.30E-07 | 1.45E-09 | 5.77E-14 | 3.64E-16 | |
| AG110M | 2.74E-03 | 9.94E-04 | 1.73E-05 | 1.09E-07 | 4.34E-12 | 2.74E-14 | 2.73E-25 |
| CD109 | 2.27E-06 | 1.32E-06 | 1.48E-07 | 9.70E-09 | 4.14E-11 | 2.70E-12 | 3.22E-18 |
| Specific Activity Total | 1.39E+06 | 4.75E+02 | 9.75E+01 | 2.49E+01 | 1.73E+00 | 4.59E-01 | 7.51E-04 |
| Total Activity (Curies) | 7.70E+05 | 2.63E+02 | 5.39E+01 | 1.38E+01 | 9.59E-01 | 2.54E-01 | 4.16E-04 |

Al 5052 Specific Activity (µCi/gm)

Part: #51 Weight: 2.04E+04 gms Flux: 2.00E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| | Years after shutdown | | | | | | |
| SI 32 | 2.12E-10 | 2.12E-10 | 2.11E-10 | 2.10E-10 | 2.08E-10 | 2.07E-10 | 2.01E-10 |
| P 32 | 1.73E-04 | 2.16E-10 | 2.11E-10 | 2.10E-10 | 2.08E-10 | 2.07E-10 | 2.01E-10 |
| FE 55 | 7.16E+01 | 5.48E+01 | 1.89E+01 | 4.98E+00 | 3.46E-01 | 9.12E-02 | 1.17E-04 |
| FE 59 | 8.69E+00 | 3.13E-02 | 5.27E-12 | 3.20E-24 | | | |
| CO 60 | 9.95E-03 | 8.73E-03 | 5.16E-03 | 2.67E-03 | 7.17E-04 | 3.71E-04 | 1.39E-05 |
| NI 63 | 1.87E-05 | 1.85E-05 | 1.80E-05 | 1.73E-05 | 1.61E-05 | 1.55E-05 | 1.28E-05 |
| ZN 65 | 1.13E+02 | 4.00E+01 | 6.28E-01 | 3.50E-03 | 1.08E-07 | 6.04E-10 | 3.23E-21 |
| AG108 | 7.84E-03 | 2.91E-07 | 2.85E-07 | 2.77E-07 | 2.63E-07 | 2.56E-07 | 2.23E-07 |
| AG108M | 3.29E-06 | 3.27E-06 | 3.20E-06 | 3.12E-06 | 2.95E-06 | 2.87E-06 | 2.51E-06 |
| AG109M | 2.21E-07 | 5.52E-08 | 6.22E-09 | 4.06E-10 | 1.73E-12 | 1.13E-13 | 1.35E-19 |
| AG110 | 1.89E-02 | 2.72E-06 | 4.72E-08 | 2.98E-10 | 1.19E-14 | 7.48E-17 | |
| AG110M | 5.63E-04 | 2.04E-04 | 3.55E-06 | 2.24E-08 | 8.92E-13 | 5.63E-15 | 5.62E-26 |
| CD109 | 9.52E-08 | 5.52E-08 | 6.22E-09 | 4.06E-10 | 1.73E-12 | 1.13E-13 | 1.35E-19 |
| Specific Activity Total | 2.78E+05 | 9.50E+01 | 1.95E+01 | 4.98E+00 | 3.47E-01 | 9.16E-02 | 1.47E-04 |
| Total Activity (Curies) | 5.68E+03 | 1.94E+00 | 3.98E-01 | 1.02E-01 | 7.07E-03 | 1.87E-03 | 2.99E-06 |

| Al 5052 Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #52 | Weight: 3.08E+03 gms | Flux: 2.00E+12 $\frac{neutrons}{cm^2\text{-}second}$ | | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| SI 32 | 5.30E-11 | 5.30E-11 | 5.28E-11 | 5.25E-11 | 5.19E-11 | 5.16E-11 | 5.03E-11 |
| P 32 | 4.33E-05 | 5.39E-11 | 5.28E-11 | 5.25E-11 | 5.19E-11 | 5.16E-11 | 5.03E-11 |
| FE 55 | 3.58E+01 | 2.74E+01 | 9.44E+00 | 2.49E+00 | 1.73E-01 | 4.56E-02 | 5.79E-05 |
| FE 59 | 4.34E+00 | 1.57E-02 | 2.64E-12 | 1.60E-24 | | | |
| CO 60 | 4.81E-03 | 4.22E-03 | 2.49E-03 | 1.29E-03 | 3.46E-04 | 1.79E-04 | 6.70E-06 |
| NI 63 | 9.34E-06 | 9.27E-06 | 8.99E-06 | 8.66E-06 | 8.03E-06 | 7.74E-06 | 6.41E-06 |
| ZN 65 | 5.64E+01 | 2.00E+01 | 3.14E-01 | 1.75E-03 | 5.42E-08 | 3.02E-10 | 1.62E-21 |
| AG108 | 3.93E-03 | 1.46E-07 | 1.43E-07 | 1.39E-07 | 1.32E-07 | 1.28E-07 | 1.12E-07 |
| AG108M | 1.65E-06 | 1.64E-06 | 1.60E-06 | 1.56E-06 | 1.48E-06 | 1.44E-06 | 1.25E-06 |
| AG109M | 5.54E-08 | 1.39E-08 | 1.56E-09 | 1.02E-10 | 4.37E-13 | 2.85E-14 | 3.40E-20 |
| AG110 | 9.48E-03 | 1.36E-06 | 2.37E-08 | 1.50E-10 | 5.95E-15 | 3.75E-17 | |
| AG110M | 2.82E-04 | 1.02E-04 | 1.78E-06 | 1.12E-08 | 4.47E-13 | 2.82E-15 | |
| CD109 | 2.39E-08 | 1.39E-08 | 1.56E-09 | 1.02E-10 | 4.37E-13 | 2.85E-14 | 3.40E-20 |
| Specific Activity Total | 1.39E+05 | 4.75E+01 | 9.75E+00 | 2.49E+00 | 1.73E-01 | 4.58E-02 | 7.24E-05 |
| Total Activity (Curies) | 4.29E+02 | 1.46E-01 | 3.00E-02 | 7.67E-03 | 5.34E-04 | 1.41E-04 | 2.23E-07 |

| Al 5052 Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #53 | Weight: 2.77E+03 gms | Flux: 6.00E+10 $\frac{neutrons}{cm^2\text{-}second}$ | | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| SI 32 | 1.91E-13 | 1.91E-13 | 1.90E-13 | 1.89E-13 | 1.87E-13 | 1.86E-13 | 1.81E-13 |
| P 32 | 1.56E-07 | 1.94E-13 | 1.90E-13 | 1.89E-13 | 1.87E-13 | 1.86E-13 | 1.81E-13 |
| FE 55 | 2.15E+00 | 1.65E+00 | 5.66E-01 | 1.49E-01 | 1.04E-02 | 2.74E-03 | 3.52E-06 |
| FE 59 | 2.60E-01 | 9.38E-04 | 1.58E-13 | 9.59E-26 | | | |
| CO 60 | 2.79E-04 | 2.45E-04 | 1.45E-04 | 7.49E-05 | 2.01E-05 | 1.04E-05 | 3.89E-07 |
| NI 63 | 5.60E-07 | 5.56E-07 | 5.40E-07 | 5.20E-07 | 4.82E-07 | 4.64E-07 | 3.85E-07 |
| ZN 65 | 3.38E+00 | 1.20E+00 | 1.88E-02 | 1.05E-04 | 3.25E-09 | 1.81E-11 | 9.69E-23 |
| AG108 | 2.36E-04 | 8.75E-09 | 8.56E-09 | 8.33E-09 | 7.89E-09 | 7.68E-09 | 6.70E-09 |
| AG108M | 9.89E-08 | 9.84E-08 | 9.62E-08 | 9.36E-08 | 8.87E-08 | 8.63E-08 | 7.53E-08 |
| AG109M | 2.00E-10 | 5.02E-11 | 5.66E-12 | 3.70E-13 | 1.58E-15 | 1.03E-16 | 1.23E-22 |
| AG110 | 5.70E-04 | 8.21E-08 | 1.43E-09 | 9.00E-12 | 3.58E-16 | 2.26E-18 | |
| AG110M | 1.70E-05 | 6.17E-06 | 1.07E-07 | 6.76E-10 | 2.69E-14 | 1.70E-16 | |
| CD109 | 8.66E-11 | 5.02E-11 | 5.66E-12 | 3.70E-13 | 1.58E-15 | 1.03E-16 | 1.23E-22 |
| Specific Activity Total | 8.35E+03 | 2.85E+00 | 5.85E-01 | 1.49E-01 | 1.04E-02 | 2.75E-03 | 4.37E-06 |
| Total Activity (Curies) | 2.31E+01 | 7.89E-03 | 1.62E-03 | 4.14E-04 | 2.88E-05 | 7.61E-06 | 1.21E-08 |

| Al 5052 Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #54 | Weight: 2.78E+04 gms | | | Flux: 2.00E+10 $\frac{neutrons}{cm^2\text{-}second}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| SI 32 | 2.12E-14 | 2.12E-14 | 2.11E-14 | 2.10E-14 | 2.08E-14 | 2.07E-14 | 2.01E-14 |
| P 32 | 1.73E-08 | 2.16E-14 | 2.11E-14 | 2.10E-14 | 2.08E-14 | 2.07E-14 | 2.01E-14 |
| FE 55 | 7.16E-01 | 5.48E-01 | 1.89E-01 | 4.98E-02 | 3.46E-03 | 9.12E-04 | 1.17E-06 |
| CO 60 | 9.29E-05 | 8.15E-05 | 4.81E-05 | 2.49E-05 | 6.69E-06 | 3.47E-06 | 1.29E-07 |
| NI 63 | 1.87E-07 | 1.85E-07 | 1.80E-07 | 1.73E-07 | 1.61E-07 | 1.55E-07 | 1.28E-07 |
| ZN 65 | 1.13E+00 | 4.00E-01 | 6.28E-03 | 3.50E-05 | 1.08E-09 | 6.04E-12 | 3.23E-23 |
| AG108 | 7.86E-05 | 2.92E-09 | 2.86E-09 | 2.78E-09 | 2.63E-09 | 2.56E-09 | 2.23E-09 |
| AG108M | 3.30E-08 | 3.28E-08 | 3.21E-08 | 3.12E-08 | 2.96E-08 | 2.88E-08 | 2.51E-08 |
| AG109M | 2.22E-11 | 5.58E-12 | 6.29E-13 | 4.11E-14 | 1.75E-16 | 1.15E-17 | 1.37E-23 |
| AG110 | 1.90E-04 | 2.74E-08 | 4.75E-10 | 3.00E-12 | 1.19E-16 | 7.53E-19 | |
| AG110M | 5.67E-06 | 2.06E-06 | 3.57E-08 | 2.25E-10 | 8.98E-15 | 5.66E-17 | |
| CD109 | 9.63E-12 | 5.58E-12 | 6.29E-13 | 4.11E-14 | 1.75E-16 | 1.15E-17 | 1.37E-23 |
| Specific Activity Total | 2.78E+03 | 9.50E-01 | 1.95E-01 | 4.98E-02 | 3.47E-03 | 9.16E-04 | 1.45E-06 |
| Total Activity (Curies) | 7.74E+01 | 2.64E-02 | 5.42E-03 | 1.38E-03 | 9.64E-05 | 2.55E-05 | 4.03E-08 |

| Al 5052 Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #55 | Weight: 1.66E+06 gms | | | Flux: 2.70E+03 $\frac{neutrons}{cm^2\text{-}second}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| FE 55 | 9.66E-08 | 7.40E-08 | 2.55E-08 | 6.72E-09 | 4.67E-10 | 1.23E-10 | 1.57E-13 |
| CO 60 | 1.25E-11 | 1.10E-11 | 6.49E-12 | 3.36E-12 | 9.03E-13 | 4.68E-13 | 1.75E-14 |
| NI 63 | 2.52E-14 | 2.50E-14 | 2.43E-14 | 2.34E-14 | 2.17E-14 | 2.09E-14 | 1.73E-14 |
| ZN 65 | 1.52E-07 | 5.39E-08 | 8.48E-10 | 4.72E-12 | 1.46E-16 | 8.51E-19 | |
| AG108 | 1.06E-11 | 3.94E-16 | 3.85E-16 | 3.75E-16 | 3.55E-16 | 3.46E-16 | 3.02E-16 |
| AG108M | 4.45E-15 | 4.43E-15 | 4.33E-15 | 4.21E-15 | 3.99E-15 | 3.88E-15 | 3.39E-15 |
| AG110 | 2.57E-11 | 3.69E-15 | 6.42E-17 | 4.05E-19 | 1.61E-23 | 1.61E-23 | |
| AG110M | 7.65E-13 | 2.78E-13 | 4.83E-15 | 3.04E-17 | 1.21E-21 | 1.21E-21 | |
| Specific Activity Total | 3.76E-04 | 1.28E-07 | 2.63E-08 | 6.73E-09 | 4.68E-10 | 1.24E-10 | 1.95E-13 |
| Total Activity (Curies) | 6.24E-04 | 2.13E-07 | 4.37E-08 | 1.12E-08 | 7.77E-10 | 2.05E-10 | 3.24E-13 |

## Al 5050 Specific Activity (µCi/gm)

Part: #61  Weight: 2.24E+05 gms  Flux: 1.00E+13 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 4.70E-09 | 4.70E-09 | 4.68E-09 | 4.65E-09 | 4.60E-09 | 4.58E-09 | 4.46E-09 |
| P 32 | 3.84E-03 | 4.78E-09 | 4.68E-09 | 4.65E-09 | 4.60E-09 | 4.58E-09 | 4.46E-09 |
| FE 55 | 3.18E+02 | 2.44E+02 | 8.38E+01 | 2.21E+01 | 1.54E+00 | 4.05E-01 | 5.17E-04 |
| FE 59 | 3.87E+01 | 1.40E-01 | 2.35E-11 | 1.43E-23 | | | |
| CO 60 | 6.12E-02 | 5.37E-02 | 3.17E-02 | 1.64E-02 | 4.41E-03 | 2.28E-03 | 8.52E-05 |
| NI 63 | 2.33E-04 | 2.31E-04 | 2.24E-04 | 2.16E-04 | 2.00E-04 | 1.93E-04 | 1.60E-04 |
| ZN 65 | 1.41E+03 | 5.00E+02 | 7.86E+00 | 4.37E-02 | 1.36E-06 | 7.54E-09 | 4.04E-20 |
| AG108 | 3.89E-02 | 1.45E-06 | 1.42E-06 | 1.38E-06 | 1.31E-06 | 1.27E-06 | 1.11E-06 |
| AG108M | 1.64E-05 | 1.63E-05 | 1.60E-05 | 1.55E-05 | 1.47E-05 | 1.43E-05 | 1.25E-05 |
| AG109M | 5.40E-06 | 1.32E-06 | 1.48E-07 | 9.70E-09 | 4.14E-11 | 2.70E-12 | 3.22E-18 |
| AG110 | 9.26E-02 | 1.32E-05 | 2.30E-07 | 1.45E-09 | 5.77E-14 | 3.64E-16 | |
| AG110M | 2.74E-03 | 9.94E-04 | 1.73E-05 | 1.09E-07 | 4.34E-12 | 2.74E-14 | 2.73E-25 |
| CD109 | 2.27E-06 | 1.32E-06 | 1.48E-07 | 9.70E-09 | 4.14E-11 | 2.70E-12 | 3.22E-18 |
| Specific Activity Total | 1.42E+06 | 7.44E+02 | 9.17E+01 | 2.22E+01 | 1.54E+00 | 4.08E-01 | 7.76E-04 |
| Total Activity (Curies) | 3.17E+05 | 1.67E+02 | 2.05E+01 | 4.97E+00 | 3.45E-01 | 9.14E-02 | 1.74E-04 |

## Al 5050 Specific Activity (µCi/gm)

Part: #62  Weight: 2.25E+05 gms  Flux: 8.00E+06 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 2.94E-21 |
| P 32 | 2.46E-15 | 3.07E-21 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 3.02E-21 | 2.94E-21 |
| FE 55 | 2.55E-04 | 1.95E-04 | 6.71E-05 | 1.77E-05 | 1.23E-06 | 3.24E-07 | 4.16E-10 |
| CO 60 | 3.71E-08 | 3.26E-08 | 1.92E-08 | 9.97E-09 | 2.67E-09 | 1.39E-09 | 5.17E-11 |
| NI 63 | 1.87E-10 | 1.85E-10 | 1.80E-10 | 1.73E-10 | 1.61E-10 | 1.55E-10 | 1.28E-10 |
| ZN 65 | 1.13E-03 | 4.00E-04 | 6.28E-06 | 3.50E-08 | 1.08E-12 | 6.04E-15 | |
| AG108 | 3.14E-08 | 1.17E-12 | 1.14E-12 | 1.11E-12 | 1.05E-12 | 1.02E-12 | 8.93E-13 |
| AG108M | 1.32E-11 | 1.31E-11 | 1.28E-11 | 1.25E-11 | 1.18E-11 | 1.15E-11 | 1.00E-11 |
| AG109M | 3.50E-18 | 8.63E-19 | 9.67E-20 | 2.03E-20 | 8.93E-21 | 8.93E-21 | |
| AG110 | 7.61E-08 | 1.09E-11 | 1.90E-13 | 1.20E-15 | 4.78E-20 | 3.01E-22 | |
| AG110M | 2.27E-09 | 8.23E-10 | 1.43E-11 | 9.02E-14 | 3.59E-18 | | |
| CD109 | 1.49E-18 | 8.58E-19 | 8.79E-20 | 2.03E-20 | 8.93E-21 | 8.93E-21 | |
| Specific Activity Total | 1.13E+00 | 5.95E-04 | 7.34E-05 | 1.77E-05 | 1.23E-06 | 3.26E-07 | 6.07E-10 |
| Total Activity (Curies) | 2.55E-01 | 1.34E-04 | 1.65E-05 | 3.99E-06 | 2.77E-07 | 7.33E-08 | 1.36E-10 |

Al 6061 Specific Activity (µCi/gm)

Part: #12 Weight: 1.45E+04 gms Flux: 6.50E+13 $\frac{neutrons}{cm^2 - second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 3.98E-07 | 3.97E-07 | 3.95E-07 | 3.93E-07 | 3.89E-07 | 3.87E-07 | 3.77E-07 |
| P 32 | 3.24E-01 | 4.04E-07 | 3.96E-07 | 3.93E-07 | 3.89E-07 | 3.87E-07 | 3.77E-07 |
| FE 55 | 3.61E+03 | 2.77E+03 | 9.52E+02 | 2.51E+02 | 1.75E+01 | 4.60E+00 | 5.86E-03 |
| FE 59 | 4.51E+02 | 1.62E+00 | 2.74E-10 | 1.66E-22 | | | |
| CO 60 | 1.39E+00 | 1.22E+00 | 7.22E-01 | 3.74E-01 | 1.00E-01 | 5.20E-02 | 1.94E-03 |
| NI 63 | 1.49E-03 | 1.48E-03 | 1.44E-03 | 1.38E-03 | 1.28E-03 | 1.23E-03 | 1.02E-03 |
| ZN 65 | 9.20E+03 | 3.26E+03 | 5.12E+01 | 2.85E-01 | 8.84E-06 | 4.92E-08 | 2.63E-19 |
| AG108 | 2.39E-01 | 9.17E-06 | 8.97E-06 | 8.73E-06 | 8.27E-06 | 8.05E-06 | 7.02E-06 |
| AG108M | 1.04E-04 | 1.03E-04 | 1.01E-04 | 9.81E-05 | 9.29E-05 | 9.04E-05 | 7.89E-05 |
| AG109M | 1.99E-04 | 4.14E-05 | 4.67E-06 | 3.05E-07 | 1.30E-09 | 8.51E-11 | 1.01E-16 |
| AG110 | 5.22E-01 | 7.12E-05 | 1.24E-06 | 7.81E-09 | 3.11E-13 | 1.96E-15 | |
| AG110M | 1.47E-02 | 5.35E-03 | 9.30E-05 | 5.87E-07 | 2.34E-11 | 1.47E-13 | 1.47E-24 |
| CD109 | 7.15E-05 | 4.14E-05 | 4.67E-06 | 3.05E-07 | 1.30E-09 | 8.51E-11 | 1.01E-16 |
| CD115M | 3.57E-12 | 1.22E-14 | 1.67E-24 | | | | |
| Specific Activity Total | 9.35E+06 | 6.03E+03 | 1.00E+03 | 2.52E+02 | 1.76E+01 | 4.66E+00 | 8.90E-03 |
| Total Activity (Curies) | 1.35E+05 | 8.73E+01 | 1.45E+01 | 3.64E+00 | 2.54E-01 | 6.74E-02 | 1.29E-04 |

Al 6061 Specific Activity (µCi/gm)

Part: #13 Weight: 6.49E+04 gms Flux: 2.10E+13 $\frac{neutrons}{cm^2 - second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 4.15E-08 | 4.14E-08 | 4.13E-08 | 4.11E-08 | 4.06E-08 | 4.04E-08 | 3.93E-08 |
| P 32 | 3.38E-02 | 4.21E-08 | 4.13E-08 | 4.11E-08 | 4.06E-08 | 4.04E-08 | 3.93E-08 |
| FE 55 | 1.17E+03 | 8.95E+02 | 3.08E+02 | 8.12E+01 | 5.65E+00 | 1.49E+00 | 1.89E-03 |
| FE 59 | 1.43E+02 | 5.15E-01 | 8.68E-11 | 5.27E-23 | | | |
| CO 60 | 2.12E-01 | 1.86E-01 | 1.10E-01 | 5.70E-02 | 1.53E-02 | 7.92E-03 | 2.96E-04 |
| NI 63 | 4.88E-04 | 4.84E-04 | 4.70E-04 | 4.52E-04 | 4.19E-04 | 4.04E-04 | 3.35E-04 |
| ZN 65 | 2.97E+03 | 1.05E+03 | 1.65E+01 | 9.19E-02 | 2.85E-06 | 1.59E-08 | 8.48E-20 |
| AG108 | 8.08E-02 | 3.03E-06 | 2.97E-06 | 2.89E-06 | 2.73E-06 | 2.66E-06 | 2.32E-06 |
| AG108M | 3.42E-05 | 3.41E-05 | 3.33E-05 | 3.24E-05 | 3.07E-05 | 2.99E-05 | 2.61E-05 |
| AG109M | 2.31E-05 | 5.45E-06 | 6.15E-07 | 4.02E-08 | 1.72E-10 | 1.12E-11 | 1.33E-17 |
| AG110 | 1.89E-01 | 2.67E-05 | 4.65E-07 | 2.93E-09 | 1.17E-13 | 7.36E-16 | |
| AG110M | 5.54E-03 | 2.01E-03 | 3.49E-05 | 2.20E-07 | 8.77E-12 | 5.53E-14 | 5.53E-25 |
| CD109 | 9.41E-06 | 5.45E-06 | 6.15E-07 | 4.02E-08 | 1.72E-10 | 1.12E-11 | 1.33E-17 |
| Specific Activity Total | 3.02E+06 | 1.95E+03 | 3.25E+02 | 8.14E+01 | 5.66E+00 | 1.50E+00 | 2.55E-03 |
| Total Activity (Curies) | 1.96E+05 | 1.26E+02 | 2.11E+01 | 5.28E+00 | 3.68E-01 | 9.72E-02 | 1.66E-04 |

## Al 6061 Specific Activity (µCi/gm)

Part: #57 Weight: 4.26E+03 gms Flux: 2.00E+12 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 3.77E-10 | 3.77E-10 | 3.75E-10 | 3.73E-10 | 3.69E-10 | 3.67E-10 | 3.58E-10 |
| P 32 | 3.08E-04 | 3.83E-10 | 3.75E-10 | 3.73E-10 | 3.69E-10 | 3.67E-10 | 3.58E-10 |
| FE 55 | 1.11E+02 | 8.53E+01 | 2.94E+01 | 7.74E+00 | 5.38E-01 | 1.42E-01 | 1.81E-04 |
| FE 59 | 1.35E+01 | 4.87E-02 | 8.20E-12 | 4.98E-24 | | | |
| CO 60 | 1.03E-02 | 9.06E-03 | 5.35E-03 | 2.77E-03 | 7.44E-04 | 3.85E-04 | 1.44E-05 |
| NI 63 | 4.67E-05 | 4.63E-05 | 4.50E-05 | 4.33E-05 | 4.02E-05 | 3.87E-05 | 3.20E-05 |
| ZN 65 | 2.82E+02 | 9.99E+01 | 1.57E+00 | 8.74E-03 | 2.71E-07 | 1.51E-09 | 8.07E-21 |
| AG108 | 7.84E-03 | 2.91E-07 | 2.85E-07 | 2.77E-07 | 2.63E-07 | 2.56E-07 | 2.23E-07 |
| AG108M | 3.29E-06 | 3.27E-06 | 3.20E-06 | 3.12E-06 | 2.95E-06 | 2.87E-06 | 2.51E-06 |
| AG109M | 2.21E-07 | 5.52E-08 | 6.22E-09 | 4.06E-10 | 1.73E-12 | 1.13E-13 | 1.35E-19 |
| AG110 | 1.89E-02 | 2.72E-06 | 4.72E-08 | 2.98E-10 | 1.19E-14 | 7.48E-17 | |
| AG110M | 5.63E-04 | 2.04E-04 | 3.55E-06 | 2.24E-08 | 8.92E-13 | 5.63E-15 | 5.62E-26 |
| CD109 | 9.52E-08 | 5.52E-08 | 6.22E-09 | 4.06E-10 | 1.73E-12 | 1.13E-13 | 1.35E-19 |
| Specific Activity Total | 2.88E+05 | 1.85E+02 | 3.09E+01 | 7.75E+00 | 5.39E-01 | 1.42E-01 | 2.30E-04 |
| Total Activity (Curies) | 1.23E+03 | 7.90E-01 | 1.32E-01 | 3.30E-02 | 2.30E-03 | 6.07E-04 | 9.82E-07 |

## Al 6061 Specific Activity (µCi/gm)

Part: #58 Weight: 3.14E+04 gms Flux: 1.30E+12 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 1.59E-10 | 1.59E-10 | 1.58E-10 | 1.58E-10 | 1.56E-10 | 1.55E-10 | 1.51E-10 |
| P 32 | 1.30E-04 | 1.62E-10 | 1.58E-10 | 1.58E-10 | 1.56E-10 | 1.55E-10 | 1.51E-10 |
| FE 55 | 7.24E+01 | 5.54E+01 | 1.91E+01 | 5.03E+00 | 3.50E-01 | 9.22E-02 | 1.18E-04 |
| FE 59 | 8.78E+00 | 3.16E-02 | 5.33E-12 | 3.23E-24 | | | |
| CO 60 | 6.48E-03 | 5.68E-03 | 3.35E-03 | 1.74E-03 | 4.67E-04 | 2.42E-04 | 9.02E-06 |
| NI 63 | 3.03E-05 | 3.01E-05 | 2.92E-05 | 2.81E-05 | 2.61E-05 | 2.51E-05 | 2.08E-05 |
| ZN 65 | 1.83E+02 | 6.49E+01 | 1.02E+00 | 5.68E-03 | 1.76E-07 | 9.81E-10 | 5.25E-21 |
| AG108 | 5.10E-03 | 1.90E-07 | 1.85E-07 | 1.81E-07 | 1.71E-07 | 1.66E-07 | 1.45E-07 |
| AG108M | 2.14E-06 | 2.13E-06 | 2.08E-06 | 2.03E-06 | 1.92E-06 | 1.87E-06 | 1.63E-06 |
| AG109M | 9.35E-08 | 2.34E-08 | 2.64E-09 | 1.72E-10 | 7.36E-13 | 4.81E-14 | 5.73E-20 |
| AG110 | 1.23E-02 | 1.77E-06 | 3.08E-08 | 1.94E-10 | 7.72E-15 | 4.87E-17 | |
| AG110M | 3.67E-04 | 1.33E-04 | 2.31E-06 | 1.46E-08 | 5.81E-13 | 3.66E-15 | |
| CD109 | 4.04E-08 | 2.34E-08 | 2.64E-09 | 1.72E-10 | 7.36E-13 | 4.81E-14 | 5.73E-20 |
| Specific Activity Total | 1.87E+05 | 1.20E+02 | 2.01E+01 | 5.04E+00 | 3.50E-01 | 9.25E-02 | 1.50E-04 |
| Total Activity (Curies) | 5.88E+03 | 3.78E+00 | 6.31E-01 | 1.58E-01 | 1.10E-02 | 2.91E-03 | 4.70E-06 |

Al 6061 Specific Activity (µCi/gm)

Part: #59 Weight: 1.99E+04 gms Flux: 7.60E+10 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 5.45E-13 | 5.44E-13 | 5.42E-13 | 5.39E-13 | 5.33E-13 | 5.31E-13 | 5.17E-13 |
| P 32 | 4.44E-07 | 5.54E-13 | 5.42E-13 | 5.39E-13 | 5.33E-13 | 5.31E-13 | 5.17E-13 |
| FE 55 | 4.23E+00 | 3.24E+00 | 1.12E+00 | 2.94E-01 | 2.04E-02 | 5.39E-03 | 6.88E-06 |
| FE 59 | 5.13E-01 | 1.85E-03 | 3.11E-13 | 1.89E-25 | | | |
| CO 60 | 3.54E-04 | 3.11E-04 | 1.84E-04 | 9.51E-05 | 2.55E-05 | 1.32E-05 | 4.93E-07 |
| NI 63 | 1.77E-06 | 1.76E-06 | 1.71E-06 | 1.65E-06 | 1.53E-06 | 1.47E-06 | 1.22E-06 |
| ZN 65 | 1.07E+01 | 3.80E+00 | 5.97E-02 | 3.32E-04 | 1.03E-08 | 5.73E-11 | 3.07E-22 |
| AG108 | 2.99E-04 | 1.11E-08 | 1.08E-08 | 1.06E-08 | 1.00E-08 | 9.73E-09 | 8.49E-09 |
| AG108M | 1.25E-07 | 1.25E-07 | 1.22E-07 | 1.19E-07 | 1.12E-07 | 1.09E-07 | 9.54E-08 |
| AG109M | 3.21E-10 | 8.05E-11 | 9.08E-12 | 5.93E-13 | 2.53E-15 | 1.66E-16 | 1.97E-22 |
| AG110 | 7.23E-04 | 1.04E-07 | 1.81E-09 | 1.14E-11 | 4.53E-16 | 2.86E-18 | |
| AG110M | 2.15E-05 | 7.82E-06 | 1.36E-07 | 8.57E-10 | 3.41E-14 | 2.15E-16 | |
| CD109 | 1.39E-10 | 8.05E-11 | 9.08E-12 | 5.93E-13 | 2.53E-15 | 1.66E-16 | 1.97E-22 |
| Specific Activity Total | 1.09E+04 | 7.04E+00 | 1.18E+00 | 2.95E-01 | 2.05E-02 | 5.41E-03 | 8.70E-06 |
| Total Activity (Curies) | 2.18E+02 | 1.40E-01 | 2.34E-02 | 5.86E-03 | 4.08E-04 | 1.08E-04 | 1.73E-07 |

Al 6061 Specific Activity (µCi/gm)

Part: #80 Weight: 7.67E+04 gms Flux: 3.10E+10 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| SI 32 | 9.07E-14 | 9.06E-14 | 9.02E-14 | 8.97E-14 | 8.88E-14 | 8.83E-14 | 8.60E-14 |
| P 32 | 7.39E-08 | 9.21E-14 | 9.02E-14 | 8.97E-14 | 8.88E-14 | 8.83E-14 | 8.60E-14 |
| FE 55 | 1.73E+00 | 1.32E+00 | 4.55E-01 | 1.20E-01 | 8.34E-03 | 2.20E-03 | 2.82E-06 |
| FE 59 | 2.09E-01 | 7.54E-04 | 1.27E-13 | 7.71E-26 | | | |
| CO 60 | 1.44E-04 | 1.26E-04 | 7.47E-05 | 3.87E-05 | 1.04E-05 | 5.38E-06 | 2.01E-07 |
| NI 63 | 7.24E-07 | 7.19E-07 | 6.97E-07 | 6.72E-07 | 6.23E-07 | 6.00E-07 | 4.97E-07 |
| ZN 65 | 4.37E+00 | 1.55E+00 | 2.44E-02 | 1.36E-04 | 4.20E-09 | 2.34E-11 | 1.25E-22 |
| AG108 | 1.22E-04 | 4.52E-09 | 4.42E-09 | 4.31E-09 | 4.08E-09 | 3.97E-09 | 3.46E-09 |
| AG108M | 5.11E-08 | 5.08E-08 | 4.97E-08 | 4.84E-08 | 4.58E-08 | 4.46E-08 | 3.89E-08 |
| AG109M | 5.34E-11 | 1.34E-11 | 1.51E-12 | 9.88E-14 | 4.22E-16 | 2.75E-17 | 3.28E-23 |
| AG110 | 2.95E-04 | 4.24E-08 | 7.37E-10 | 4.65E-12 | 1.85E-16 | 1.17E-18 | |
| AG110M | 8.78E-06 | 3.19E-06 | 5.54E-08 | 3.50E-10 | 1.39E-14 | 8.78E-17 | |
| CD109 | 2.31E-11 | 1.34E-11 | 1.51E-12 | 9.88E-14 | 4.21E-16 | 2.75E-17 | 3.28E-23 |
| Specific Activity Total | 4.47E+03 | 2.87E+00 | 4.79E-01 | 1.20E-01 | 8.35E-03 | 2.21E-03 | 3.56E-06 |
| Total Activity (Curies) | 3.43E+02 | 2.20E-01 | 3.68E-02 | 9.22E-03 | 6.41E-04 | 1.69E-04 | 2.73E-07 |

Al 6061 Specific Activity (μCi/gm)

Part: #81 Weight: 1.02E+05 gms Flux: 1.80E+05 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| FE 55 | 1.00E-05 | 7.68E-06 | 2.64E-06 | 6.97E-07 | 4.84E-08 | 1.28E-08 | 1.63E-11 |
| CO 60 | 8.36E-10 | 7.33E-10 | 4.33E-10 | 2.24E-10 | 6.02E-11 | 3.12E-11 | 1.16E-12 |
| NI 63 | 4.20E-12 | 4.17E-12 | 4.05E-12 | 3.90E-12 | 3.62E-12 | 3.48E-12 | 2.88E-12 |
| ZN 65 | 2.54E-05 | 8.99E-06 | 1.41E-07 | 7.87E-10 | 2.44E-14 | 1.36E-16 | |
| AG108 | 7.07E-10 | 2.63E-14 | 2.57E-14 | 2.50E-14 | 2.37E-14 | 2.30E-14 | 2.01E-14 |
| AG108M | 2.97E-13 | 2.95E-13 | 2.89E-13 | 2.81E-13 | 2.66E-13 | 2.59E-13 | 2.26E-13 |
| AG110 | 1.71E-09 | 2.46E-13 | 4.28E-15 | 2.70E-17 | 1.07E-21 | 6.78E-24 | |
| AG110M | 5.10E-11 | 1.85E-11 | 3.22E-13 | 2.03E-15 | 8.08E-20 | | |
| Specific Activity Total | 2.59E-02 | 1.67E-05 | 2.78E-06 | 6.98E-07 | 4.85E-08 | 1.28E-08 | 2.06E-11 |
| Total Activity (Curies) | 2.65E-03 | 1.70E-06 | 2.84E-07 | 7.12E-08 | 4.95E-09 | 1.31E-09 | 2.10E-12 |

Type 304 - Stainless Steel Specific Activity (μCi/gm)

Part: #21 Weight: 6.33E+04 gms Flux: 4.00E+08 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| C 14 | 4.61E-10 | 4.61E-10 | 4.61E-10 | 4.60E-10 | 4.60E-10 | 4.59E-10 | 4.58E-10 |
| SI 32 | 1.89E-17 | 1.89E-17 | 1.88E-17 | 1.87E-17 | 1.85E-17 | 1.84E-17 | 1.79E-17 |
| P 32 | 1.70E-02 | 3.48E-10 | 1.88E-17 | 1.87E-17 | 1.85E-17 | 1.84E-17 | 1.79E-17 |
| S 35 | 5.66E-04 | 3.19E-05 | 3.21E-10 | 1.81E-16 | | | |
| CL 36 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 |
| FE 55 | 2.22E+00 | 1.70E+00 | 5.86E-01 | 1.54E-01 | 1.07E-02 | 2.83E-03 | 3.60E-06 |
| FE 59 | 2.69E-01 | 9.71E-04 | 1.64E-13 | 9.92E-26 | | | |
| CO 60 | 8.91E-01 | 7.81E-01 | 4.61E-01 | 2.39E-01 | 6.42E-02 | 3.32E-02 | 1.24E-03 |
| NI 59 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 |
| NI 63 | 4.47E-02 | 4.44E-02 | 4.31E-02 | 4.15E-02 | 3.85E-02 | 3.71E-02 | 3.07E-02 |
| Specific Activity Total | 5.71E+01 | 2.53E+00 | 1.09E+00 | 4.35E-01 | 1.14E-01 | 7.35E-02 | 3.23E-02 |
| Total Activity (Curies) | 3.61E+00 | 1.60E-01 | 6.91E-02 | 2.76E-02 | 7.20E-03 | 4.65E-03 | 2.04E-03 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #22 | Weight: 5.92E+04 gms | | Flux: 4.00E+07 $\frac{neutrons}{cm^2 - second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 4.61E-11 | 4.61E-11 | 4.60E-11 | 4.60E-11 | 4.60E-11 | 4.59E-11 | 4.58E-11 |
| SI 32 | 1.89E-19 | 1.88E-19 | 1.88E-19 | 1.87E-19 | 1.85E-19 | 1.84E-19 | 1.79E-19 |
| P 32 | 1.70E-03 | 3.48E-11 | 1.88E-19 | 1.87E-19 | 1.85E-19 | 1.84E-19 | 1.79E-19 |
| S 35 | 5.67E-05 | 3.19E-06 | 3.21E-11 | 1.81E-17 | | | |
| CL 36 | 1.48E-18 | 1.48E-18 | 1.48E-18 | 1.48E-18 | 1.48E-18 | 1.48E-18 | 1.48E-18 |
| FE 55 | 2.22E-01 | 1.70E-01 | 5.86E-02 | 1.55E-02 | 1.07E-03 | 2.83E-04 | 3.63E-07 |
| CO 60 | 8.91E-02 | 7.81E-02 | 4.61E-02 | 2.39E-02 | 6.42E-03 | 3.32E-03 | 1.24E-04 |
| NI 59 | 3.18E-05 | 3.18E-05 | 3.18E-05 | 3.18E-05 | 3.18E-05 | 3.18E-05 | 3.18E-05 |
| NI 63 | 4.47E-03 | 4.44E-03 | 4.31E-03 | 4.15E-03 | 3.85E-03 | 3.71E-03 | 3.07E-03 |
| Specific Activity Total | 5.71E+00 | 2.53E-01 | 1.09E-01 | 4.35E-02 | 1.14E-02 | 7.35E-03 | 3.23E-03 |
| Total Activity (Curies) | 3.38E-01 | 1.50E-02 | 6.46E-03 | 2.58E-03 | 6.73E-04 | 4.35E-04 | 1.91E-04 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #23 | Weight: 1.23E+05 gms | | Flux: 1.50E+05 $\frac{neutrons}{cm^2 - second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 1.73E-13 | 1.73E-13 | 1.73E-13 | 1.73E-13 | 1.72E-13 | 1.72E-13 | 1.72E-13 |
| S 35 | 2.12E-07 | 1.20E-08 | 1.20E-13 | 6.80E-20 | | | |
| CL 36 | 2.05E-23 | 2.05E-23 | 2.05E-23 | 2.05E-23 | 2.05E-23 | 2.05E-23 | 2.05E-23 |
| FE 55 | 8.33E-04 | 6.38E-04 | 2.20E-04 | 5.79E-05 | 4.03E-06 | 1.06E-06 | 1.36E-09 |
| CO 60 | 3.34E-04 | 2.93E-04 | 1.73E-04 | 8.96E-05 | 2.41E-05 | 1.25E-05 | 4.65E-07 |
| NI 59 | 1.19E-07 | 1.19E-07 | 1.19E-07 | 1.19E-07 | 1.19E-07 | 1.19E-07 | 1.19E-07 |
| NI 63 | 1.68E-05 | 1.67E-05 | 1.62E-05 | 1.56E-05 | 1.44E-05 | 1.39E-05 | 1.15E-05 |
| Specific Activity Total | 2.14E-02 | 9.49E-04 | 4.09E-04 | 1.63E-04 | 4.26E-05 | 2.75E-05 | 1.21E-05 |
| Total Activity (Curies) | 2.62E-03 | 1.16E-04 | 5.01E-05 | 2.00E-05 | 5.22E-06 | 3.37E-06 | 1.48E-06 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #24 | Weight: 4.35E+05 gms | | Flux: 7.50E+01 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | | | Years after shutdown | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 8.64E-17 | 8.64E-17 | 8.63E-17 | 8.63E-17 | 8.62E-17 | 8.61E-17 | 8.59E-17 |
| S 35 | 1.06E-10 | 5.98E-12 | 6.01E-17 | 3.40E-23 | | | |
| FE 55 | 4.17E-07 | 3.19E-07 | 1.10E-07 | 2.90E-08 | 2.01E-09 | 5.31E-10 | 6.76E-13 |
| CO 60 | 1.67E-07 | 1.46E-07 | 8.65E-08 | 4.48E-08 | 1.20E-08 | 6.23E-09 | 2.32E-10 |
| NI 59 | 5.96E-11 | 5.96E-11 | 5.96E-11 | 5.96E-11 | 5.96E-11 | 5.96E-11 | 5.96E-11 |
| NI 63 | 8.39E-09 | 8.33E-09 | 8.08E-09 | 7.78E-09 | 7.22E-09 | 6.95E-09 | 5.76E-09 |
| Specific Activity Total | 1.07E-05 | 4.74E-07 | 2.05E-07 | 8.16E-08 | 2.13E-08 | 1.38E-08 | 6.05E-09 |
| Total Activity (Curies) | 4.65E-06 | 2.06E-07 | 8.90E-08 | 3.55E-08 | 9.27E-09 | 5.99E-09 | 2.63E-09 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #31 | Weight: 7.78E+05 gms | | Flux: 2.52E+11 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | | | Years after shutdown | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 3.62E-20 | 3.62E-20 | 2.81E-20 | 2.02E-20 | 1.20E-20 | 8.66E-21 | 1.05E-21 |
| C 14 | 2.90E-07 | 2.90E-07 | 2.90E-07 | 2.90E-07 | 2.90E-07 | 2.89E-07 | 2.89E-07 |
| SI 32 | 7.49E-12 | 7.48E-12 | 7.45E-12 | 7.41E-12 | 7.33E-12 | 7.29E-12 | 7.10E-12 |
| P 32 | 1.07E+01 | 2.20E-07 | 7.45E-12 | 7.41E-12 | 7.33E-12 | 7.29E-12 | 7.10E-12 |
| S 35 | 3.57E-01 | 2.01E-02 | 2.02E-07 | 1.14E-13 | | | |
| CL 36 | 5.86E-11 | 5.86E-11 | 5.86E-11 | 5.86E-11 | 5.86E-11 | 5.86E-11 | 5.86E-11 |
| AR 39 | 6.17E-18 | 6.15E-18 | 6.09E-18 | 6.01E-18 | 5.86E-18 | 5.78E-18 | 5.42E-18 |
| FE 55 | 1.40E+03 | 1.07E+03 | 3.69E+02 | 9.73E+01 | 6.77E+00 | 1.78E+00 | 2.28E-03 |
| FE 59 | 1.70E+02 | 6.11E-01 | 1.03E-10 | 6.25E-23 | | | |
| CO 60 | 5.61E+02 | 4.92E+02 | 2.91E+02 | 1.51E+02 | 4.04E+01 | 2.09E+01 | 7.81E-01 |
| NI 59 | 2.00E-01 | 2.00E-01 | 2.00E-01 | 2.00E-01 | 2.00E-01 | 2.00E-01 | 2.00E-01 |
| NI 63 | 2.82E+01 | 2.80E+01 | 2.71E+01 | 2.61E+01 | 2.42E+01 | 2.34E+01 | 1.93E+01 |
| ZN 65 | 5.76E-11 | 2.04E-11 | 3.20E-13 | 1.79E-15 | 5.53E-20 | | |
| Specific Activity Total | 3.60E+04 | 1.59E+03 | 6.87E+02 | 2.74E+02 | 7.16E+01 | 4.63E+01 | 2.03E+01 |
| Total Activity (Curies) | 2.80E+04 | 1.24E+03 | 5.34E+02 | 2.13E+02 | 5.57E+01 | 3.60E+01 | 1.58E+01 |

Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #33  Weight: 3.03E+04 gms  Flux: 5.00E+02 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 5.76E-16 | 5.76E-16 | 5.76E-16 | 5.75E-16 | 5.75E-16 | 5.74E-16 | 5.73E-16 |
| S 35 | 7.08E-10 | 3.99E-11 | 4.01E-16 | 2.27E-22 | | | |
| FE 55 | 2.78E-06 | 2.13E-06 | 7.32E-07 | 1.93E-07 | 1.34E-08 | 3.54E-09 | 4.54E-12 |
| CO 60 | 1.11E-06 | 9.76E-07 | 5.77E-07 | 2.99E-07 | 8.02E-08 | 4.15E-08 | 1.55E-09 |
| NI 59 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 |
| NI 63 | 5.59E-08 | 5.55E-08 | 5.39E-08 | 5.19E-08 | 4.81E-08 | 4.63E-08 | 3.84E-08 |
| Specific Activity Total | 7.13E-05 | 3.16E-06 | 1.36E-06 | 5.44E-07 | 1.42E-07 | 9.18E-08 | 4.03E-08 |
| Total Activity (Curies) | 2.16E-06 | 9.58E-08 | 4.13E-08 | 1.65E-08 | 4.31E-09 | 2.78E-09 | 1.22E-09 |

Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #34  Weight: 7.80E+05 gms  Flux: 5.00E+02 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 5.76E-16 | 5.76E-16 | 5.76E-16 | 5.75E-16 | 5.75E-16 | 5.74E-16 | 5.73E-16 |
| S 35 | 7.08E-10 | 3.99E-11 | 4.01E-16 | 2.27E-22 | | | |
| FE 55 | 2.78E-06 | 2.13E-06 | 7.32E-07 | 1.93E-07 | 1.34E-08 | 3.54E-09 | 4.54E-12 |
| CO 60 | 1.11E-06 | 9.76E-07 | 5.77E-07 | 2.99E-07 | 8.02E-08 | 4.15E-08 | 1.55E-09 |
| NI 59 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 | 3.98E-10 |
| NI 63 | 5.59E-08 | 5.55E-08 | 5.39E-08 | 5.19E-08 | 4.81E-08 | 4.63E-08 | 3.84E-08 |
| Specific Activity Total | 7.13E-05 | 3.16E-06 | 1.36E-06 | 5.44E-07 | 1.42E-07 | 9.18E-08 | 4.03E-08 |
| Total Activity (Curies) | 5.56E-05 | 2.46E-06 | 1.06E-06 | 4.24E-07 | 1.11E-07 | 7.16E-08 | 3.14E-08 |

## Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #41 Weight: 1.19E+05 gms Flux: 2.00E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 2.01E-17 | 1.90E-17 | 1.52E-17 | 1.15E-17 | 6.55E-18 | 4.95E-18 | 1.22E-18 |
| C 14 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.29E-06 |
| SI 32 | 4.71E-10 | 4.71E-10 | 4.69E-10 | 4.66E-10 | 4.62E-10 | 4.59E-10 | 4.47E-10 |
| P 32 | 8.51E+01 | 1.74E-06 | 4.69E-10 | 4.66E-10 | 4.62E-10 | 4.59E-10 | 4.47E-10 |
| S 35 | 2.83E+00 | 1.60E-01 | 1.60E-06 | 9.07E-13 | 2.91E-25 | | |
| CL 36 | 3.69E-09 | 3.69E-09 | 3.69E-09 | 3.69E-09 | 3.69E-09 | 3.69E-09 | 3.69E-09 |
| AR 39 | 3.06E-15 | 3.05E-15 | 3.02E-15 | 2.98E-15 | 2.91E-15 | 2.87E-15 | 2.69E-15 |
| FE 55 | 1.11E+04 | 8.51E+03 | 2.93E+03 | 7.72E+02 | 5.37E+01 | 1.42E+01 | 1.81E-02 |
| FE 59 | 1.35E+03 | 4.86E+00 | 8.18E-10 | 4.97E-22 | | | |
| CO 60 | 4.45E+03 | 3.90E+03 | 2.30E+03 | 1.19E+03 | 3.20E+02 | 1.66E+02 | 6.19E+00 |
| NI 59 | 1.59E+00 | 1.59E+00 | 1.59E+00 | 1.59E+00 | 1.58E+00 | 1.58E+00 | 1.58E+00 |
| NI 63 | 2.24E+02 | 2.22E+02 | 2.15E+02 | 2.07E+02 | 1.92E+02 | 1.85E+02 | 1.53E+02 |
| ZN 65 | 2.88E-08 | 1.02E-08 | 1.60E-10 | 8.92E-13 | 2.76E-17 | 1.29E-19 | |
| Specific Activity Total | 2.85E+05 | 1.27E+04 | 5.45E+03 | 2.18E+03 | 5.68E+02 | 3.67E+02 | 1.61E+02 |
| Total Activity (Curies) | 3.40E+04 | 1.51E+03 | 6.50E+02 | 2.59E+02 | 6.[illegible]7E+01 | 4.37E+01 | 1.92E+01 |

## Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #42 Weight: 4.42E+05 gms Flux: 1.50E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 8.49E-18 | 8.03E-18 | 6.41E-18 | 4.84E-18 | 2.76E-18 | 2.09E-18 | 5.12E-19 |
| C 14 | 1.73E-06 | 1.73E-06 | 1.73E-06 | 1.73E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 |
| SI 32 | 2.65E-10 | 2.65E-10 | 2.64E-10 | 2.62E-10 | 2.60E-10 | 2.58E-10 | 2.51E-10 |
| P 32 | 6.38E+01 | 1.31E-06 | 2.64E-10 | 2.62E-10 | 2.60E-10 | 2.58E-10 | 2.52E-10 |
| S 35 | 2.12E+00 | 1.20E-01 | 1.20E-06 | 6.80E-13 | 2.18E-25 | | |
| CL 36 | 2.07E-09 | 2.07E-09 | 2.07E-09 | 2.07E-09 | 2.07E-09 | 2.07E-09 | 2.07E-09 |
| AR 39 | 1.29E-15 | 1.29E-15 | 1.28E-15 | 1.26E-15 | 1.23E-15 | 1.21E-15 | 1.14E-15 |
| FE 55 | 8.33E+03 | 6.38E+03 | 2.20E+03 | 5.79E+02 | 4.03E+01 | 1.06E+01 | 1.35E-02 |
| FE 59 | 1.01E+03 | 3.64E+00 | 6.13E-10 | 3.72E-22 | | | |
| CO 60 | 3.34E+03 | 2.93E+03 | 1.73E+03 | 8.96E+02 | 2.40E+02 | 1.25E+02 | 4.65E+00 |
| NI 59 | 1.19E+00 | 1.19E+00 | 1.19E+00 | 1.19E+00 | 1.19E+00 | 1.19E+00 | 1.19E+00 |
| NI 63 | 1.68E+02 | 1.66E+02 | 1.62E+02 | 1.56E+02 | 1.44E+02 | 1.39E+02 | 1.15E+02 |
| ZN 65 | 1.21E-08 | 4.30E-09 | 6.76E-11 | 3.76E-13 | 1.17E-17 | 1.01E-19 | |
| Specific Activity Total | 2.14E+05 | 9.49E+03 | 4.09E+03 | 1.63E+03 | 4.26E+02 | 2.75E+02 | 1.21E+02 |
| Total Activity (Curies) | 9.45E+04 | 4.19E+03 | 1.81E+03 | 7.21E+02 | 1.88E+02 | 1.22E+02 | 5.34E+01 |

**Type 304 - Stainless Steel Specific Activity (µCi/gm)**

Part: #43 Weight: 7.13E+05 gms Flux: 1.20E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 4.35E-18 | 4.11E-18 | 3.28E-18 | 2.48E-18 | 1.41E-18 | 1.07E-18 | 2.64E-19 |
| C 14 | 1.38E-06 | 1.38E-06 | 1.38E-06 | 1.38E-06 | 1.38E-06 | 1.38E-06 | 1.37E-06 |
| SI 32 | 1.70E-10 | 1.70E-10 | 1.69E-10 | 1.68E-10 | 1.66E-10 | 1.65E-10 | 1.61E-10 |
| P 32 | 5.11E+01 | 1.04E-06 | 1.69E-10 | 1.68E-10 | 1.66E-10 | 1.65E-10 | 1.61E-10 |
| S 35 | 1.70E+00 | 9.57E-02 | 9.62E-07 | 5.44E-13 | 1.74E-25 | | |
| CL 36 | 1.33E-09 | 1.33E-09 | 1.33E-09 | 1.33E-09 | 1.33E-09 | 1.33E-09 | 1.33E-09 |
| AR 39 | 6.63E-16 | 6.61E-16 | 6.55E-16 | 6.46E-16 | 6.30E-16 | 6.22E-16 | 5.83E-16 |
| FE 55 | 6.66E+03 | 5.11E+03 | 1.76E+03 | 4.63E+02 | 3.22E+01 | 8.50E+00 | 1.09E-02 |
| FE 59 | 8.08E+02 | 2.91E+00 | 4.91E-10 | 2.98E-22 | | | |
| CO 60 | 2.67E+03 | 2.34E+03 | 1.38E+03 | 7.17E+02 | 1.92E+02 | 9.96E+01 | 3.72E+00 |
| NI 59 | 9.53E-01 | 9.53E-01 | 9.53E-01 | 9.53E-01 | 9.52E-01 | 9.52E-01 | 9.52E-01 |
| NI 63 | 1.34E+02 | 1.33E+02 | 1.29E+02 | 1.24E+02 | 1.15E+02 | 1.11E+02 | 9.21E+01 |
| ZN 65 | 6.21E-09 | 2.20E-09 | 3.46E-11 | 1.93E-13 | 5.97E-18 | 5.20E-20 | |
| Specific Activity Total | 1.71E+05 | 7.59E+03 | 3.27E+03 | 1.31E+03 | 3.41E+02 | 2.20E+02 | 9.68E+01 |
| Total Activity (Curies) | 1.22E+05 | 5.41E+03 | 2.33E+03 | 9.30E+02 | 2.43E+02 | 1.57E+02 | 6.90E+01 |

**Type 304 - Stainless Steel Specific Activity (µCi/gm)**

Part: #44 Weight: 3.93E+04 gms Flux: 1.00E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 2.51E-18 | 2.37E-18 | 1.89E-18 | 1.43E-18 | 8.16E-19 | 6.16E-19 | 1.53E-19 |
| C 14 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 |
| SI 32 | 1.18E-10 | 1.18E-10 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| P 32 | 4.26E+01 | 8.71E-07 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| S 35 | 1.42E+00 | 7.97E-02 | 8.01E-07 | 4.54E-13 | 1.45E-25 | | |
| CL 36 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 |
| AR 39 | 3.84E-16 | 3.83E-16 | 3.79E-16 | 3.74E-16 | 3.65E-16 | 3.60E-16 | 3.38E-16 |
| FE 55 | 5.55E+03 | 4.25E+03 | 1.46E+03 | 3.86E+02 | 2.69E+01 | 7.08E+00 | 9.12E-03 |
| FE 59 | 6.73E+02 | 2.42E+00 | 4.09E-10 | 2.48E-22 | | | |
| CO 60 | 2.23E+03 | 1.95E+03 | 1.15E+03 | 5.97E+02 | 1.60E+02 | 8.30E+01 | 3.10E+00 |
| NI 59 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 |
| NI 63 | 1.12E+02 | 1.11E+02 | 1.08E+02 | 1.04E+02 | 9.62E+01 | 9.26E+01 | 7.67E+01 |
| ZN 65 | 3.60E-09 | 1.27E-09 | 2.00E-11 | 1.12E-13 | 3.46E-18 | | |
| Specific Activity Total | 1.43E+05 | 6.32E+03 | 2.73E+03 | 1.09E+03 | 2.84E+02 | 1.84E+02 | 8.06E+01 |
| Total Activity (Curies) | 5.60E+03 | 2.49E+02 | 1.07E+02 | 4.28E+01 | 1.12E+01 | 7.21E+00 | 3.17E+00 |

| Type 304 - Stainless Steel Specific Activity (μCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #45 | Weight: 4.14E+04 gms | Flux: 1.00E+12 $\frac{neutrons}{cm^2-second}$ | | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 2.51E-18 | 2.37E-18 | 1.89E-18 | 1.43E-18 | 8.16E-19 | 6.16E-19 | 1.53E-19 |
| C 14 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 | 1.15E-06 |
| SI 32 | 1.18E-10 | 1.18E-10 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| P 32 | 4.26E+01 | 8.71E-07 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| S 35 | 1.42E+00 | 7.97E-02 | 8.01E-07 | 4.54E-13 | 1.45E-25 | | |
| CL 36 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 | 9.22E-10 |
| AR 39 | 3.84E-16 | 3.83E-16 | 3.79E-16 | 3.74E-16 | 3.65E-16 | 3.60E-16 | 3.38E-16 |
| FE 55 | 5.55E+03 | 4.25E+03 | 1.46E+03 | 3.86E+02 | 2.69E+01 | 7.08E+00 | 9.12E-03 |
| FE 59 | 6.73E+02 | 2.42E+00 | 4.09E-10 | 2.48E-22 | | | |
| CO 60 | 2.23E+03 | 1.95E+03 | 1.15E+03 | 5.97E+02 | 1.60E+02 | 8.30E+01 | 3.10E+00 |
| NI 59 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 | 7.94E-01 |
| NI 63 | 1.12E+02 | 1.11E+02 | 1.08E+02 | 1.04E+02 | 9.62E+01 | 9.26E+01 | 7.67E+01 |
| ZN 65 | 3.60E-09 | 1.27E-09 | 2.00E-11 | 1.12E-13 | 3.46E-18 | | |
| Specific Activity Total | 1.43E+05 | 6.32E+03 | 2.73E+03 | 1.09E+03 | 2.84E+02 | 1.84E+02 | 8.06E+01 |
| Total Activity (Curies) | 5.90E+03 | 2.62E+02 | 1.13E+02 | 4.50E+01 | 1.18E+01 | 7.60E+00 | 3.34E+00 |

| Type 304 - Stainless Steel Specific Activity (μCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #46 | Weight: 5.39E+05 gms | Flux: 5.00E+11 $\frac{neutrons}{cm^2-second}$ | | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 4.61E-09 | 4.61E-09 | 4.60E-09 | 4.60E-09 | 4.60E-09 | 4.59E-09 | 4.58E-09 |
| SI 32 | 1.89E-15 | 1.89E-15 | 1.88E-15 | 1.87E-15 | 1.85E-15 | 1.84E-15 | 1.79E-15 |
| P 32 | 1.70E-01 | 3.48E-09 | 1.88E-15 | 1.87E-15 | 1.85E-15 | 1.84E-15 | 1.79E-15 |
| S 35 | 5.66E-03 | 3.19E-04 | 3.21E-09 | 1.81E-15 | | | |
| CL 36 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 |
| FE 55 | 2.22E+01 | 1.70E+01 | 5.86E+00 | 1.54E+00 | 1.07E-01 | 2.83E-02 | 3.63E-05 |
| FE 59 | 2.69E+00 | 9.70E-03 | 1.63E-12 | 9.92E-25 | | | |
| CO 60 | 8.91E+00 | 7.81E+00 | 4.61E+00 | 2.39E+00 | 6.41E-01 | 3.32E-01 | 1.24E-02 |
| NI 59 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 |
| NI 63 | 4.48E-01 | 4.44E-01 | 4.31E-01 | 4.15E-01 | 3.85E-01 | 3.71E-01 | 3.07E-01 |
| ZN 65 | 2.32E-16 | 8.23E-17 | 1.27E-18 | 4.61E-20 | 1.43E-24 | 1.43E-24 | |
| Specific Activity Total | 5.71E+02 | 2.53E+01 | 1.09E+01 | 4.35E+00 | 1.14E+00 | 7.35E-01 | 3.23E-01 |
| Total Activity (Curies) | 3.08E+02 | 1.36E+01 | 5.88E+00 | 2.35E+00 | 6.13E-01 | 3.96E-01 | 1.74E-01 |

**Type 304 - Stainless Steel Specific Activity (µCi/gm)**

Part: #47 Weight: 7.47E+05 gms Flux: 2.00E+11 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.81E-20 | 1.81E-20 | 1.40E-20 | 1.01E-20 | 4.43E-21 | 4.43E-21 | 2.57E-21 |
| C 14 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.29E-07 |
| SI 32 | 4.72E-12 | 4.71E-12 | 4.69E-12 | 4.67E-12 | 4.62E-12 | 4.59E-12 | 4.47E-12 |
| P 32 | 8.51E+00 | 1.74E-07 | 4.69E-12 | 4.67E-12 | 4.62E-12 | 4.59E-12 | 4.47E-12 |
| S 35 | 2.83E-01 | 1.59E-02 | 1.60E-07 | 9.07E-14 | | | |
| CL 36 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 |
| AR 39 | 3.08E-18 | 3.08E-18 | 3.04E-18 | 3.01E-18 | 2.93E-18 | 2.89E-18 | 2.71E-18 |
| FE 55 | 1.11E+03 | 8.51E+02 | 2.93E+02 | 7.72E+01 | 5.37E+00 | 1.42E+00 | 1.81E-03 |
| FE 59 | 1.35E+02 | 4.85E-01 | 8.17E-11 | 4.96E-23 | | | |
| CO 60 | 4.45E+02 | 3.90E+02 | 2.31E+02 | 1.20E+02 | 3.21E+01 | 1.66E+01 | 6.20E-01 |
| NI 59 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 |
| NI 63 | 2.24E+01 | 2.22E+01 | 2.16E+01 | 2.08E+01 | 1.92E+01 | 1.85E+01 | 1.53E+01 |
| ZN 65 | 2.88E-11 | 1.02E-11 | 1.60E-13 | 8.92E-16 | 2.77E-20 | 3.55E-20 | |
| Specific Activity Total | 2.85E+04 | 1.27E+03 | 5.45E+02 | 2.18E+02 | 5.69E+01 | 3.67E+01 | 1.61E+01 |
| Total Activity (Curies) | 2.13E+04 | 9.45E+02 | 4.07E+02 | 1.63E+02 | 4.25E+01 | 2.74E+01 | 1.20E+01 |

**Type 304 - Stainless Steel Specific Activity (µCi/gm)**

Part: #48 Weight: 6.52E+05 gms Flux: 2.00E+11 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.81E-20 | 1.81E-20 | 1.40E-20 | 1.01E-20 | 4.43E-21 | 4.43E-21 | 2.57E-21 |
| C 14 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.30E-07 | 2.29E-07 |
| SI 32 | 4.72E-12 | 4.71E-12 | 4.69E-12 | 4.67E-12 | 4.62E-12 | 4.59E-12 | 4.47E-12 |
| P 32 | 8.51E+00 | 1.74E-07 | 4.69E-12 | 4.67E-12 | 4.62E-12 | 4.59E-12 | 4.47E-12 |
| S 35 | 2.83E-01 | 1.59E-02 | 1.60E-07 | 9.07E-14 | | | |
| CL 36 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 | 3.69E-11 |
| AR 39 | 3.08E-18 | 3.08E-18 | 3.04E-18 | 3.01E-18 | 2.93E-18 | 2.89E-18 | 2.71E-18 |
| FE 55 | 1.11E+03 | 8.51E+02 | 2.93E+02 | 7.72E+01 | 5.37E+00 | 1.42E+00 | 1.81E-03 |
| FE 59 | 1.35E+02 | 4.85E-01 | 8.17E-11 | 4.96E-23 | | | |
| CO 60 | 4.45E+02 | 3.90E+02 | 2.31E+02 | 1.20E+02 | 3.21E+01 | 1.66E+01 | 6.20E-01 |
| NI 59 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 | 1.59E-01 |
| NI 63 | 2.24E+01 | 2.22E+01 | 2.16E+01 | 2.08E+01 | 1.92E+01 | 1.85E+01 | 1.53E+01 |
| ZN 65 | 2.88E-11 | 1.02E-11 | 1.60E-13 | 8.92E-16 | 2.77E-20 | 3.55E-20 | |
| Specific Activity Total | 2.85E+04 | 1.27E+03 | 5.45E+02 | 2.18E+02 | 5.69E+01 | 3.67E+01 | 1.61E+01 |
| Total Activity (Curies) | 1.86E+04 | 8.25E+02 | 3.56E+02 | 1.42E+02 | 3.71E+01 | 2.39E+01 | 1.05E+01 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #56 | Weight: 2.15E+05 gms | | Flux: 4.00E+09 $\frac{neutrons}{cm^2 - second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 4.61E-09 | 4.61E-09 | 4.60E-09 | 4.60E-09 | 4.60E-09 | 4.59E-09 | 4.58E-09 |
| SI 32 | 1.89E-15 | 1.89E-15 | 1.88E-15 | 1.87E-15 | 1.85E-15 | 1.84E-15 | 1.79E-15 |
| P 32 | 1.70E-01 | 3.48E-09 | 1.88E-15 | 1.87E-15 | 1.85E-15 | 1.84E-15 | 1.79E-15 |
| S 35 | 5.66E-03 | 3.19E-04 | 3.21E-09 | 1.81E-15 | | | |
| CL 36 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 | 1.48E-14 |
| FE 55 | 2.22E+01 | 1.70E+01 | 5.86E+00 | 1.54E+00 | 1.07E-01 | 2.83E-02 | 3.63E-05 |
| FE 59 | 2.69E+00 | 9.70E-03 | 1.63E-12 | 9.92E-25 | | | |
| CO 60 | 8.91E+00 | 7.81E+00 | 4.61E+00 | 2.39E+00 | 6.41E-01 | 3.32E-01 | 1.24E-02 |
| NI 59 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 |
| NI 63 | 4.48E-01 | 4.44E-01 | 4.31E-01 | 4.15E-01 | 3.85E-01 | 3.71E-01 | 3.07E-01 |
| ZN 65 | 2.32E-16 | 8.23E-17 | 1.27E-18 | 4.61E-20 | 1.43E-24 | 1.43E-24 | |
| Specific Activity Total | 5.71E+02 | 2.53E+01 | 1.09E+01 | 4.35E+00 | 1.14E+00 | 7.35E-01 | 3.23E-01 |
| Total Activity (Curies) | 1.23E+02 | 5.44E+00 | 2.35E+00 | 9.36E-01 | 2.44E-01 | 1.58E-01 | 6.94E-02 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #71 | Weight: 1.80E+05 gms | | Flux: 3.90E+03 $\frac{neutrons}{cm^2 - second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 4.49E-15 | 4.49E-15 | 4.49E-15 | 4.49E-15 | 4.48E-15 | 4.48E-15 | 4.46E-15 |
| S 35 | 5.52E-09 | 3.11E-10 | 3.13E-15 | 1.77E-21 | | | |
| FE 55 | 2.17E-05 | 1.66E-05 | 5.71E-06 | 1.51E-06 | 1.05E-07 | 2.76E-08 | 3.54E-11 |
| CO 60 | 8.68E-06 | 7.61E-06 | 4.50E-06 | 2.33E-06 | 6.25E-07 | 3.24E-07 | 1.21E-08 |
| NI 59 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 |
| NI 63 | 4.36E-07 | 4.33E-07 | 4.20E-07 | 4.05E-07 | 3.75E-07 | 3.61E-07 | 2.99E-07 |
| Specific Activity Total | 5.56E-04 | 2.47E-05 | 1.06E-05 | 4.25E-06 | 1.11E-06 | 7.16E-07 | 3.15E-07 |
| Total Activity (Curies) | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #72 | Weight: 5.80E+04 gms | | Flux: 1.50E+09 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 1.73E-09 | 1.73E-09 | 1.73E-09 | 1.73E-09 | 1.72E-09 | 1.72E-09 | 1.72E-09 |
| SI 32 | 2.65E-16 | 2.65E-16 | 2.64E-16 | 2.62E-16 | 2.60E-16 | 2.58E-16 | 2.52E-16 |
| P 32 | 6.38E-02 | 1.31E-09 | 2.64E-16 | 2.62E-16 | 2.60E-16 | 2.58E-16 | 2.52E-16 |
| S 35 | 2.12E-03 | 1.20E-04 | 1.20E-09 | 6.80E-16 | | | |
| CL 36 | 2.08E-15 | 2.08E-15 | 2.08E-15 | 2.08E-15 | 2.08E-15 | 2.08E-15 | 2.08E-15 |
| FE 55 | 8.33E+00 | 6.38E+00 | 2.20E+00 | 5.79E-01 | 4.03E-02 | 1.06E-02 | 1.35E-05 |
| FE 59 | 1.01E+00 | 3.64E-03 | 6.13E-13 | 3.72E-25 | | | |
| CO 60 | 3.34E+00 | 2.93E+00 | 1.73E+00 | 8.96E-01 | 2.41E-01 | 1.25E-01 | 4.65E-03 |
| NI 59 | 1.19E-03 | 1.19E-03 | 1.19E-03 | 1.19E-03 | 1.19E-03 | 1.19E-03 | 1.19E-03 |
| NI 63 | 1.68E-01 | 1.67E-01 | 1.62E-01 | 1.56E-01 | 1.44E-01 | 1.39E-01 | 1.15E-01 |
| Specific Activity Total | 2.14E+02 | 9.49E+00 | 4.09E+00 | 1.63E+00 | 4.26E-01 | 2.76E-01 | 1.21E-01 |
| Total Activity (Curies) | 1.24E+01 | 5.50E-01 | 2.37E-01 | 9.47E-02 | 2.47E-02 | 1.60E-02 | 7.02E-03 |

| Type 304 - Stainless Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #73 | Weight: 1.80E+05 gms | | Flux: 3.90E+03 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| C 14 | 4.49E-15 | 4.49E-15 | 4.49E-15 | 4.49E-15 | 4.48E-15 | 4.48E-15 | 4.46E-15 |
| S 35 | 5.52E-09 | 3.11E-10 | 3.13E-15 | 1.77E-21 | | | |
| FE 55 | 2.17E-05 | 1.66E-05 | 5.71E-06 | 1.51E-06 | 1.05E-07 | 2.76E-08 | 3.54E-11 |
| CO 60 | 8.68E-06 | 7.61E-06 | 4.50E-06 | 2.33E-06 | 6.25E-07 | 3.24E-07 | 1.21E-08 |
| NI 59 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 | 3.10E-09 |
| NI 63 | 4.36E-07 | 4.33E-07 | 4.20E-07 | 4.05E-07 | 3.75E-07 | 3.61E-07 | 2.99E-07 |
| Specific Activity Total | 5.56E-04 | 2.47E-05 | 1.06E-05 | 4.25E-06 | 1.11E-06 | 7.16E-07 | 3.15E-07 |
| Total Activity (Curies) | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |

Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #74 Weight: 6.30E+04 gms Flux: 2.00E+09 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| C 14 | 2.30E-09 | 2.30E-09 | 2.30E-09 | 2.30E-09 | 2.30E-09 | 2.30E-09 | 2.29E-09 |
| SI 32 | 4.72E-16 | 4.71E-16 | 4.69E-16 | 4.67E-16 | 4.62E-16 | 4.59E-16 | 4.47E-16 |
| P 32 | 8.51E-02 | 1.74E-09 | 4.69E-16 | 4.67E-16 | 4.62E-16 | 4.59E-16 | 4.47E-16 |
| S 35 | 2.83E-03 | 1.60E-04 | 1.60E-09 | 9.07E-16 | | | |
| CL 36 | 3.69E-15 | 3.69E-15 | 3.69E-15 | 3.69E-15 | 3.69E-15 | 3.69E-15 | 3.69E-15 |
| FE 55 | 1.11E+01 | 8.51E+00 | 2.93E+00 | 7.72E-01 | 5.37E-02 | 1.42E-02 | 1.81E-05 |
| FE 59 | 1.35E+00 | 4.85E-03 | 8.17E-13 | 4.96E-25 | | | |
| CO 60 | 4.45E+00 | 3.90E+00 | 2.31E+00 | 1.20E+00 | 3.21E-01 | 1.66E-01 | 6.20E-03 |
| NI 59 | 1.59E-03 | 1.59E-03 | 1.59E-03 | 1.59E-03 | 1.59E-03 | 1.59E-03 | 1.59E-03 |
| NI 63 | 2.24E-01 | 2.22E-01 | 2.15E-01 | 2.07E-01 | 1.93E-01 | 1.85E-01 | 1.53E-01 |
| ZN 65 | 2.90E-17 | 1.02E-17 | 1.19E-19 | 2.82E-20 | 8.75E-25 | 8.75E-25 | |
| Specific Activity Total | 2.85E+02 | 1.27E+01 | 5.45E+00 | 2.18E+00 | 5.69E-01 | 3.67E-01 | 1.61E-01 |
| Total Activity (Curies) | 1.80E+01 | 7.97E-01 | 3.44E-01 | 1.37E-01 | 3.58E-02 | 2.31E-02 | 1.02E-02 |

Type 304 - Stainless Steel Specific Activity (µCi/gm)

Part: #75 Weight: 3.10E+04 gms Flux: 1.70E+10 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| C 14 | 1.96E-08 | 1.96E-08 | 1.96E-08 | 1.96E-08 | 1.95E-08 | 1.95E-08 | 1.95E-08 |
| SI 32 | 3.41E-14 | 3.40E-14 | 3.39E-14 | 3.37E-14 | 3.34E-14 | 3.32E-14 | 3.23E-14 |
| P 32 | 7.24E-01 | 1.48E-08 | 3.39E-14 | 3.37E-14 | 3.34E-14 | 3.32E-14 | 3.23E-14 |
| S 35 | 2.41E-02 | 1.36E-03 | 1.36E-08 | 7.71E-15 | | | |
| CL 36 | 2.67E-13 | 2.67E-13 | 2.67E-13 | 2.67E-13 | 2.67E-13 | 2.67E-13 | 2.67E-13 |
| AR 39 | 1.70E-21 | 1.70E-21 | 1.70E-21 | 1.70E-21 | 1.70E-21 | 1.70E-21 | 1.70E-21 |
| FE 55 | 9.44E+01 | 7.23E+01 | 2.49E+01 | 6.57E+00 | 4.57E-01 | 1.20E-01 | 1.54E-04 |
| FE 59 | 1.14E+01 | 4.12E-02 | 6.95E-12 | 4.22E-24 | | | |
| CO 60 | 3.79E+01 | 3.32E+01 | 1.96E+01 | 1.02E+01 | 2.73E+00 | 1.41E+00 | 5.27E-02 |
| NI 59 | 1.35E-02 | 1.35E-02 | 1.35E-02 | 1.35E-02 | 1.35E-02 | 1.35E-02 | 1.35E-02 |
| NI 63 | 1.90E+00 | 1.89E+00 | 1.83E+00 | 1.76E+00 | 1.64E+00 | 1.58E+00 | 1.30E+00 |
| ZN 65 | 1.78E-14 | 6.30E-15 | 9.90E-17 | 5.76E-19 | 1.79E-23 | 1.79E-23 | |
| Specific Activity Total | 2.43E+03 | 1.08E+02 | 4.64E+01 | 1.85E+01 | 4.83E+00 | 3.12E+00 | 1.37E+00 |
| Total Activity (Curies) | 7.52E+01 | 3.33E+00 | 1.44E+00 | 5.74E-01 | 1.50E-01 | 9.68E-02 | 4.25E-02 |

**Type A-212 - Steel Specific Activity (µCi/gm)**

Part: #41 Weight: 1.84E+05 gms Flux: 2.00E+12 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 2.77E-12 | 2.62E-12 | 2.09E-12 | 1.58E-12 | 9.01E-13 | 6.80E-13 | 1.67E-13 |
| C 14 | 6.69E-02 | 6.69E-02 | 6.69E-02 | 6.68E-02 | 6.67E-02 | 6.67E-02 | 6.65E-02 |
| SI 32 | 1.18E-10 | 1.18E-10 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| P 32 | 9.46E+01 | 1.94E-06 | 1.17E-10 | 1.17E-10 | 1.15E-10 | 1.15E-10 | 1.12E-10 |
| S 35 | 5.67E+00 | 3.19E-01 | 3.21E-06 | 1.81E-12 | 5.81E-25 | | |
| CL 36 | 7.38E-09 | 7.38E-09 | 7.38E-09 | 7.38E-09 | 7.38E-09 | 7.38E-09 | 7.38E-09 |
| AR 39 | 6.12E-15 | 6.10E-15 | 6.04E-15 | 5.96E-15 | 5.81E-15 | 5.74E-15 | 5.38E-15 |
| FE 55 | 1.54E+04 | 1.18E+04 | 4.07E+03 | 1.07E+03 | 7.46E+01 | 1.97E+01 | 2.51E-02 |
| FE 59 | 1.87E+03 | 6.74E+00 | 1.14E-09 | 6.90E-22 | | | |
| CO 60 | 1.11E+03 | 9.75E+02 | 5.76E+02 | 2.99E+02 | 8.01E+01 | 4.15E+01 | 1.55E+00 |
| NI 59 | 6.61E-02 | 6.61E-02 | 6.61E-02 | 6.61E-02 | 6.61E-02 | 6.61E-02 | 6.60E-02 |
| NI 63 | 9.31E+00 | 9.24E+00 | 8.97E+00 | 8.64E+00 | 8.01E+00 | 7.71E+00 | 6.39E+00 |
| ZN 65 | 4.40E-02 | 1.56E-02 | 2.45E-04 | 1.37E-06 | 4.23E-11 | 2.36E-13 | 1.26E-24 |
| Specific Activity Total | 1.07E+05 | 1.28E+04 | 4.65E+03 | 1.38E+03 | 1.63E+02 | 6.90E+01 | 8.10E+00 |
| Total Activity (Curies) | 1.97E+04 | 2.36E+03 | 8.56E+02 | 2.54E+02 | 3.00E+01 | 1.27E+01 | 1.49E+00 |

**Type A-212 - Steel Specific Activity (µCi/gm)**

Part: #42 Weight: 6.04E+05 gms Flux: 1.50E+12 $\frac{neutrons}{cm^2\text{-}second}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.17E-12 | 1.10E-12 | 8.82E-13 | 6.66E-13 | 3.80E-13 | 2.87E-13 | 7.05E-14 |
| C 14 | 5.02E-02 | 5.02E-02 | 5.01E-02 | 5.01E-02 | 5.00E-02 | 5.00E-02 | 4.99E-02 |
| SI 32 | 6.63E-11 | 6.62E-11 | 6.60E-11 | 6.56E-11 | 6.49E-11 | 6.46E-11 | 6.29E-11 |
| P 32 | 7.09E+01 | 1.45E-06 | 6.60E-11 | 6.56E-11 | 6.49E-11 | 6.46E-11 | 6.29E-11 |
| S 35 | 4.25E+00 | 2.39E-01 | 2.40E-06 | 1.36E-12 | 4.36E-25 | | |
| CL 36 | 4.15E-09 | 4.15E-09 | 4.15E-09 | 4.15E-09 | 4.15E-09 | 4.15E-09 | 4.15E-09 |
| AR 39 | 2.59E-15 | 2.58E-15 | 2.55E-15 | 2.52E-15 | 2.46E-15 | 2.43E-15 | 2.27E-15 |
| FE 55 | 1.16E+04 | 8.86E+03 | 3.05E+03 | 8.04E+02 | 5.59E+01 | 1.48E+01 | 1.88E-02 |
| FE 59 | 1.40E+03 | 5.06E+00 | 8.52E-10 | 5.17E-22 | | | |
| CO 60 | 8.34E+02 | 7.32E+02 | 4.32E+02 | 2.24E+02 | 6.01E+01 | 3.11E+01 | 1.16E+00 |
| NI 59 | 4.96E-02 | 4.96E-02 | 4.96E-02 | 4.96E-02 | 4.96E-02 | 4.96E-02 | 4.96E-02 |
| NI 63 | 6.99E+00 | 6.93E+00 | 6.73E+00 | 6.48E+00 | 6.01E+00 | 5.79E+00 | 4.79E+00 |
| ZN 65 | 2.48E-02 | 8.77E-03 | 1.38E-04 | 7.68E-07 | 2.38E-11 | 1.33E-13 | 7.09E-25 |
| Specific Activity Total | 8.02E+04 | 9.61E+03 | 3.49E+03 | 1.04E+03 | 1.22E+02 | 5.18E+01 | 6.07E+00 |
| Total Activity (Curies) | 4.84E+04 | 5.80E+03 | 2.11E+03 | 6.25E+02 | 7.37E+01 | 3.13E+01 | 3.67E+00 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #43 Weight: 2.01E+06 gms Flux: 1.20E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 5.98E-13 | 5.65E-13 | 4.51E-13 | 3.41E-13 | 1.95E-13 | 1.47E-13 | 3.61E-14 |
| C 14 | 4.01E-02 | 4.01E-02 | 4.01E-02 | 4.01E-02 | 4.00E-02 | 4.00E-02 | 3.99E-02 |
| SI 32 | 4.24E-11 | 4.24E-11 | 4.22E-11 | 4.20E-11 | 4.15E-11 | 4.13E-11 | 4.02E-11 |
| P 32 | 5.67E+01 | 1.16E-06 | 4.22E-11 | 4.20E-11 | 4.15E-11 | 4.13E-11 | 4.02E-11 |
| S 35 | 3.40E+00 | 1.91E-01 | 1.92E-06 | 1.09E-12 | 3.49E-25 | | |
| CL 36 | 2.66E-09 | 2.66E-09 | 2.66E-09 | 2.66E-09 | 2.66E-09 | 2.66E-09 | 2.66E-09 |
| AR 39 | 1.33E-15 | 1.32E-15 | 1.31E-15 | 1.29E-15 | 1.26E-15 | 1.24E-15 | 1.17E-15 |
| FE 55 | 9.26E+03 | 7.09E+03 | 2.44E+03 | 6.44E+02 | 4.48E+01 | 1.18E+01 | 1.50E-02 |
| FE 59 | 1.12E+03 | 4.04E+00 | 6.82E-10 | 4.14E-22 | | | |
| CO 60 | 6.68E+02 | 5.85E+02 | 3.46E+02 | 1.79E+02 | 4.81E+01 | 2.49E+01 | 9.29E-01 |
| NI 59 | 3.97E-02 | 3.97E-02 | 3.97E-02 | 3.97E-02 | 3.97E-02 | 3.97E-02 | 3.97E-02 |
| NI 63 | 5.59E+00 | 5.55E+00 | 5.38E+00 | 5.18E+00 | 4.81E+00 | 4.63E+00 | 3.84E+00 |
| ZN 65 | 1.59E-02 | 5.62E-03 | 8.83E-05 | 4.91E-07 | 1.52E-11 | 8.48E-14 | 4.54E-25 |
| Specific Activity Total | 6.42E+04 | 7.69E+03 | 2.79E+03 | 8.28E+02 | 9.77E+01 | 4.14E+01 | 4.86E+00 |
| Total Activity (Curies) | 1.29E+05 | 1.54E+04 | 5.61E+03 | 1.66E+03 | 1.96E+02 | 8.33E+01 | 9.77E+00 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #44 Weight: 6.19E+05 gms Flux: 1.00E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 3.46E-13 | 3.27E-13 | 2.61E-13 | 1.97E-13 | 1.13E-13 | 8.50E-14 | 2.09E-14 |
| C 14 | 3.35E-02 | 3.34E-02 | 3.34E-02 | 3.34E-02 | 3.34E-02 | 3.33E-02 | 3.32E-02 |
| SI 32 | 2.95E-11 | 2.94E-11 | 2.93E-11 | 2.92E-11 | 2.88E-11 | 2.87E-11 | 2.79E-11 |
| P 32 | 4.73E+01 | 9.68E-07 | 2.93E-11 | 2.92E-11 | 2.88E-11 | 2.87E-11 | 2.79E-11 |
| S 35 | 2.83E+00 | 1.60E-01 | 1.60E-06 | 9.07E-13 | 2.91E-25 | | |
| CL 36 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 |
| AR 39 | 7.68E-16 | 7.66E-16 | 7.58E-16 | 7.49E-16 | 7.30E-16 | 7.20E-16 | 6.75E-16 |
| FE 55 | 7.71E+03 | 5.91E+03 | 2.03E+03 | 5.36E+02 | 3.73E+01 | 9.83E+00 | 1.26E-02 |
| FE 59 | 9.36E+02 | 3.37E+00 | 5.68E-10 | 3.45E-22 | | | |
| CO 60 | 5.56E+02 | 4.88E+02 | 2.88E+02 | 1.49E+02 | 4.01E+01 | 2.08E+01 | 7.75E-01 |
| NI 59 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 |
| NI 63 | 4.66E+00 | 4.62E+00 | 4.49E+00 | 4.32E+00 | 4.01E+00 | 3.86E+00 | 3.20E+00 |
| ZN 65 | 1.10E-02 | 3.90E-03 | 6.13E-05 | 3.41E-07 | 1.06E-11 | 5.89E-14 | 3.15E-25 |
| Specific Activity Total | 5.35E+04 | 6.40E+03 | 2.33E+03 | 6.90E+02 | 8.14E+01 | 3.45E+01 | 4.05E+00 |
| Total Activity (Curies) | 3.31E+04 | 3.96E+03 | 1.44E+03 | 4.27E+02 | 5.04E+01 | 2.14E+01 | 2.51E+00 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #45    Weight: 6.66E+05 gms    Flux: $1.00E+12 \frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 3.46E-13 | 3.27E-13 | 2.61E-13 | 1.97E-13 | 1.13E-13 | 8.50E-14 | 2.09E-14 |
| C 14 | 3.35E-02 | 3.34E-02 | 3.34E-02 | 3.34E-02 | 3.34E-02 | 3.33E-02 | 3.32E-02 |
| SI 32 | 2.95E-11 | 2.94E-11 | 2.93E-11 | 2.92E-11 | 2.88E-11 | 2.87E-11 | 2.79E-11 |
| P 32 | 4.73E+01 | 9.68E-07 | 2.93E-11 | 2.92E-11 | 2.88E-11 | 2.87E-11 | 2.79E-11 |
| S 35 | 2.83E+00 | 1.60E-01 | 1.60E-06 | 9.07E-13 | 2.91E-25 | | |
| CL 36 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 | 1.84E-09 |
| AR 39 | 7.68E-16 | 7.66E-16 | 7.58E-16 | 7.49E-16 | 7.30E-16 | 7.20E-16 | 6.75E-16 |
| FE 55 | 7.71E+03 | 5.91E+03 | 2.03E+03 | 5.36E+02 | 3.73E+01 | 9.83E+00 | 1.26E-02 |
| FE 59 | 9.36E+02 | 3.37E+00 | 5.68E-10 | 3.45E-22 | | | |
| CO 60 | 5.56E+02 | 4.88E+02 | 2.88E+02 | 1.49E+02 | 4.01E+01 | 2.08E+01 | 7.75E-01 |
| NI 59 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 | 3.31E-02 |
| NI 63 | 4.66E+00 | 4.62E+00 | 4.49E+00 | 4.32E+00 | 4.01E+00 | 3.86E+00 | 3.20E+00 |
| ZN 65 | 1.10E-02 | 3.90E-03 | 6.13E-05 | 3.41E-07 | 1.06E-11 | 5.89E-14 | 3.15E-25 |
| Specific Activity Total | 5.35E+04 | 6.40E+03 | 2.33E+03 | 6.90E+02 | 8.14E+01 | 3.45E+01 | 4.05E+00 |
| Total Activity (Curies) | 3.56E+04 | 4.27E+03 | 1.55E+03 | 4.60E+02 | 5.42E+01 | 2.30E+01 | 2.70E+00 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #46    Weight: 5.67E+06 gms    Flux: $5.00E+11 \frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 4.32E-14 | 4.09E-14 | 3.26E-14 | 2.47E-14 | 1.41E-14 | 1.06E-14 | 2.61E-15 |
| C 14 | 1.67E-02 | 1.67E-02 | 1.67E-02 | 1.67E-02 | 1.67E-02 | 1.67E-02 | 1.66E-02 |
| SI 32 | 7.37E-12 | 7.36E-12 | 7.33E-12 | 7.29E-12 | 7.22E-12 | 7.18E-12 | 6.99E-12 |
| P 32 | 2.36E+01 | 4.84E-07 | 7.33E-12 | 7.29E-12 | 7.22E-12 | 7.18E-12 | 6.99E-12 |
| S 35 | 1.42E+00 | 7.97E-02 | 8.01E-07 | 4.54E-13 | 1.45E-25 | | |
| CL 36 | 4.61E-10 | 4.61E-10 | 4.61E-10 | 4.61E-10 | 4.61E-10 | 4.61E-10 | 4.61E-10 |
| AR 39 | 9.63E-17 | 9.60E-17 | 9.50E-17 | 9.38E-17 | 9.14E-17 | 9.03E-17 | 8.46E-17 |
| FE 55 | 3.86E+03 | 2.95E+03 | 1.02E+03 | 2.68E+02 | 1.86E+01 | 4.92E+00 | 6.29E-03 |
| FE 59 | 4.68E+02 | 1.69E+00 | 2.84E-10 | 1.73E-22 | | | |
| CO 60 | 2.78E+02 | 2.44E+02 | 1.44E+02 | 7.47E+01 | 2.00E+01 | 1.04E+01 | 3.87E-01 |
| NI 59 | 1.66E-02 | 1.66E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 |
| NI 63 | 2.33E+00 | 2.31E+00 | 2.24E+00 | 2.16E+00 | 2.00E+00 | 1.93E+00 | 1.60E+00 |
| ZN 65 | 2.75E-03 | 9.75E-04 | 1.53E-05 | 8.53E-08 | 2.65E-12 | 1.47E-14 | 7.88E-26 |
| Specific Activity Total | 2.67E+04 | 3.20E+03 | 1.16E+03 | 3.45E+02 | 4.07E+01 | 1.73E+01 | 2.03E+00 |
| Total Activity (Curies) | 1.52E+05 | 1.82E+04 | 6.59E+03 | 1.96E+03 | 2.31E+02 | 9.79E+01 | 1.15E+01 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #47    Weight: 1.22E+07 gms    Flux: 2.00E+11 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 2.77E-15 | 2.62E-15 | 2.09E-15 | 1.58E-15 | 9.00E-16 | 6.80E-16 | 1.67E-16 |
| C 14 | 6.69E-03 | 6.69E-03 | 6.68E-03 | 6.68E-03 | 6.67E-03 | 6.67E-03 | 6.65E-03 |
| SI 32 | 1.18E-12 | 1.18E-12 | 1.17E-12 | 1.17E-12 | 1.15E-12 | 1.15E-12 | 1.12E-12 |
| P 32 | 9.46E+00 | 1.94E-07 | 1.17E-12 | 1.17E-12 | 1.15E-12 | 1.15E-12 | 1.12E-12 |
| S 35 | 5.67E-01 | 3.19E-02 | 3.21E-07 | 1.81E-13 | 5.81E-26 | | |
| CL 36 | 7.38E-11 | 7.38E-11 | 7.38E-11 | 7.38E-11 | 7.38E-11 | 7.38E-11 | 7.38E-11 |
| AR 39 | 6.17E-18 | 6.15E-18 | 6.09E-18 | 6.01E-18 | 5.86E-18 | 5.78E-18 | 5.42E-18 |
| FE 55 | 1.54E+03 | 1.18E+03 | 4.07E+02 | 1.07E+02 | 7.46E+00 | 1.97E+00 | 2.52E-03 |
| FE 59 | 1.87E+02 | 6.74E-01 | 1.13E-10 | 6.89E-23 | | | |
| CO 60 | 1.11E+02 | 9.76E+01 | 5.77E+01 | 2.99E+01 | 8.02E+00 | 4.15E+00 | 1.55E-01 |
| NI 59 | 6.62E-03 | 6.62E-03 | 6.62E-03 | 6.62E-03 | 6.62E-03 | 6.62E-03 | 6.62E-03 |
| NI 63 | 9.32E-01 | 9.25E-01 | 8.98E-01 | 8.65E-01 | 8.02E-01 | 7.72E-01 | 6.40E-01 |
| ZN 65 | 4.40E-04 | 1.56E-04 | 2.45E-06 | 1.37E-08 | 4.23E-13 | 2.36E-15 | |
| Specific Activity Total | 1.07E+04 | 1.28E+03 | 4.65E+02 | 1.38E+02 | 1.63E+01 | 6.91E+00 | 8.10E-01 |
| Total Activity (Curies) | 1.31E+05 | 1.56E+04 | 5.68E+03 | 1.68E+03 | 1.99E+02 | 8.43E+01 | 9.89E+00 |

## Type A-212 - Steel Specific Activity (µCi/gm)

Part: #48    Weight: 6.49E+06 gms    Flux: 1.00E+10 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 3.39E-19 | 3.20E-19 | 2.56E-19 | 1.94E-19 | 1.10E-19 | 8.36E-20 | 1.98E-20 |
| C 14 | 3.34E-04 | 3.34E-04 | 3.34E-04 | 3.34E-04 | 3.34E-04 | 3.33E-04 | 3.32E-04 |
| SI 32 | 2.95E-15 | 2.94E-15 | 2.93E-15 | 2.92E-15 | 2.89E-15 | 2.87E-15 | 2.79E-15 |
| P 32 | 4.73E-01 | 9.68E-09 | 2.93E-15 | 2.92E-15 | 2.89E-15 | 2.87E-15 | 2.79E-15 |
| S 35 | 2.83E-02 | 1.60E-03 | 1.60E-08 | 9.07E-15 | | | |
| CL 36 | 1.85E-13 | 1.85E-13 | 1.85E-13 | 1.85E-13 | 1.85E-13 | 1.85E-13 | 1.84E-13 |
| AR 39 | 5.77E-22 | 5.77E-22 | 5.77E-22 | 5.77E-22 | 5.77E-22 | 5.77E-22 | 5.77E-22 |
| FE 55 | 7.71E+01 | 5.91E+01 | 2.03E+01 | 5.36E+00 | 3.73E-01 | 9.83E-02 | 1.25E-04 |
| FE 59 | 9.35E+00 | 3.37E-02 | 5.68E-12 | 3.45E-24 | | | |
| CO 60 | 5.57E+00 | 4.88E+00 | 2.88E+00 | 1.49E+00 | 4.01E-01 | 2.08E-01 | 7.75E-03 |
| NI 59 | 3.31E-04 | 3.31E-04 | 3.31E-04 | 3.31E-04 | 3.31E-04 | 3.31E-04 | 3.31E-04 |
| NI 63 | 4.66E-02 | 4.63E-02 | 4.49E-02 | 4.32E-02 | 4.01E-02 | 3.86E-02 | 3.20E-02 |
| ZN 65 | 1.12E-06 | 3.97E-07 | 6.25E-09 | 3.48E-11 | 1.08E-15 | 6.02E-18 | |
| Specific Activity Total | 5.35E+02 | 6.40E+01 | 2.33E+01 | 6.90E+00 | 8.15E-01 | 3.45E-01 | 4.05E-02 |
| Total Activity (Curies) | 3.47E+03 | 4.16E+02 | 1.51E+02 | 4.48E+01 | 5.29E+00 | 2.24E+00 | 2.63E-01 |

| Type A-7 Steel Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #35 | Weight: 7.56E+05 gms | | Flux: 2.50E+04 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| S 35 | 7.08E-08 | 3.99E-09 | 4.01E-14 | 2.27E-20 | | | |
| CL 36 | 9.34E-25 | 9.34E-25 | 9.34E-25 | 9.34E-25 | 9.34E-25 | 9.34E-25 | 9.34E-25 |
| FE 55 | 1.96E-04 | 1.50E-04 | 5.16E-05 | 1.36E-05 | 9.47E-07 | 2.50E-07 | 3.19E-10 |
| CO 60 | 2.78E-06 | 2.44E-06 | 1.44E-06 | 7.47E-07 | 2.01E-07 | 1.04E-07 | 3.88E-09 |
| NI 59 | 1.66E-10 | 1.66E-10 | 1.66E-10 | 1.66E-10 | 1.66E-10 | 1.66E-10 | 1.66E-10 |
| NI 63 | 2.33E-08 | 2.31E-08 | 2.24E-08 | 2.16E-08 | 2.01E-08 | 1.93E-08 | 1.60E-08 |
| Specific Activity Total | 1.22E-03 | 1.52E-04 | 5.31E-05 | 1.44E-05 | 1.17E-06 | 3.73E-07 | 2.04E-08 |
| Total Activity (Curies) | 9.24E-04 | 1.15E-04 | 4.01E-05 | 1.09E-05 | 8.82E-07 | 2.82E-07 | 1.54E-08 |

| Lead Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #41 | Weight: 1.78E+04 gms | | | Flux: 2.00E+12 $\frac{neutrons}{cm^2\text{-}second}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| CO 60 | 3.77E-20 | 3.77E-20 | 1.79E-20 | 6.12E-21 | | | |
| NI 63 | 2.81E-07 | 2.79E-07 | 2.71E-07 | 2.61E-07 | 2.42E-07 | 2.33E-07 | 1.93E-07 |
| ZN 65 | 1.70E+00 | 6.02E-01 | 9.46E-03 | 5.27E-05 | 1.63E-09 | 9.09E-12 | 4.86E-23 |
| AG108 | 1.07E+03 | 3.97E-02 | 3.88E-02 | 3.78E-02 | 3.58E-02 | 3.48E-02 | 3.04E-02 |
| AG108M | 4.48E-01 | 4.46E-01 | 4.36E-01 | 4.24E-01 | 4.02E-01 | 3.91E-01 | 3.41E-01 |
| AG109M | 3.01E-02 | 7.50E-03 | 8.46E-04 | 5.53E-05 | 2.36E-07 | 1.54E-08 | 1.84E-14 |
| AG110 | 2.57E+03 | 3.70E-01 | 6.42E-03 | 4.05E-05 | 1.61E-09 | 1.02E-11 | 1.02E-22 |
| AG110M | 7.66E+01 | 2.78E+01 | 4.83E-01 | 3.05E-03 | 1.21E-07 | 7.65E-10 | 7.65E-21 |
| CD109 | 1.29E-02 | 7.50E-03 | 8.46E-04 | 5.53E-05 | 2.36E-07 | 1.54E-08 | 1.84E-14 |
| IN113M | 2.81E-01 | 3.12E-02 | 4.71E-06 | 7.89E-11 | 2.21E-20 | 3.71E-25 | |
| SN113 | 2.81E-01 | 3.12E-02 | 4.71E-06 | 7.89E-11 | 2.21E-20 | 3.70E-25 | |
| SN119M | 9.54E-02 | 3.40E-02 | 5.44E-04 | 3.11E-06 | 1.01E-10 | 5.77E-13 | 3.49E-24 |
| SN121M | 1.62E-04 | 1.59E-04 | 1.51E-04 | 1.41E-04 | 1.22E-04 | 1.14E-04 | 8.08E-05 |
| SN123 | 2.80E-01 | 3.94E-02 | 1.55E-05 | 8.60E-10 | 2.64E-18 | 1.47E-22 | |
| SB124 | 7.22E+01 | 1.08E+00 | 5.32E-08 | 3.92E-17 | | | |
| SB125 | 6.19E-02 | 4.83E-02 | 1.77E-02 | 5.08E-03 | 4.16E-04 | 1.19E-04 | 2.29E-07 |
| TE123 | 5.00E-16 | 6.33E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 |
| TE123M | 4.62E-03 | 5.57E-04 | 1.18E-07 | 3.00E-12 | 1.95E-21 | 4.97E-26 | |
| TE125M | 1.09E-02 | 1.17E-02 | 4.33E-03 | 1.24E-03 | 1.02E-04 | 2.90E-05 | 5.58E-08 |
| TE127 | 6.94E-10 | 4.10E-12 | 3.78E-16 | 3.42E-21 | | | |
| TE127M | 4.27E-11 | 4.18E-12 | 3.86E-16 | 3.49E-21 | | | |
| TL206 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 2.95E-05 | 2.95E-05 | 2.95E-05 | 2.95E-05 | 2.95E-05 | 2.95E-05 | 2.95E-05 |
| BI210M | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 | 2.21E-07 |
| PO210 | 1.20E+00 | 2.01E-01 | 1.34E-04 | 1.52E-08 | 8.86E-10 | 8.86E-10 | 8.86E-10 |
| Specific Activity Total | 5.53E+03 | 3.07E+01 | 9.98E-01 | 4.72E-01 | 4.38E-01 | 4.26E-01 | 3.71E-01 |
| Total Activity (Curies) | 9.85E+01 | 5.47E-01 | 1.78E-02 | 8.40E-03 | 7.80E-03 | 7.58E-03 | 6.61E-03 |

**Lead Specific Activity (μCi/gm)**

Part: #42 Weight: 6.23E+05 gms Flux: 1.50E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| CO 60 | 1.26E-25 | 1.29E-24 | 1.29E-24 | 1.29E-24 | 1.29E-24 | 1.29E-24 | 1.29E-24 |
| NI 63 | 2.11E-07 | 2.09E-07 | 2.03E-07 | 1.95E-07 | 1.81E-07 | 1.75E-07 | 1.45E-07 |
| ZN 65 | 1.27E+00 | 4.51E-01 | 7.09E-03 | 3.95E-05 | 1.22E-09 | 6.81E-12 | 3.64E-23 |
| AG108 | 8.01E+02 | 2.97E-02 | 2.91E-02 | 2.83E-02 | 2.68E-02 | 2.61E-02 | 2.28E-02 |
| AG108M | 3.36E-01 | 3.34E-01 | 3.27E-01 | 3.18E-01 | 3.01E-01 | 2.93E-01 | 2.56E-01 |
| AG109M | 1.69E-02 | 4.23E-03 | 4.77E-04 | 3.12E-05 | 1.33E-07 | 8.70E-09 | 1.04E-14 |
| AG110 | 1.93E+03 | 2.78E-01 | 4.83E-03 | 3.05E-05 | 1.21E-09 | 7.65E-12 | 7.64E-23 |
| AG110M | 5.75E+01 | 2.09E+01 | 3.63E-01 | 2.29E-03 | 9.11E-08 | 5.75E-10 | 5.75E-21 |
| CD109 | 7.30E-03 | 4.23E-03 | 4.77E-04 | 3.12E-05 | 1.33E-07 | 8.70E-09 | 1.04E-14 |
| IN113M | 2.11E-01 | 2.34E-02 | 3.54E-06 | 5.92E-11 | 1.66E-20 | 2.78E-25 | |
| SN113 | 2.11E-01 | 2.34E-02 | 3.53E-06 | 5.92E-11 | 1.66E-20 | 2.78E-25 | |
| SN119M | 7.16E-02 | 2.55E-02 | 4.08E-04 | 2.33E-06 | 7.58E-11 | 4.33E-13 | 2.62E-24 |
| SN121M | 1.21E-04 | 1.20E-04 | 1.13E-04 | 1.06E-04 | 9.18E-05 | 8.57E-05 | 6.06E-05 |
| SN123 | 2.10E-01 | 2.95E-02 | 1.16E-05 | 6.45E-10 | 1.98E-18 | 1.10E-22 | |
| SB124 | 5.41E+01 | 8.07E-01 | 3.99E-08 | 2.94E-17 | | | |
| SB125 | 4.62E-02 | 3.61E-02 | 1.32E-02 | 3.79E-03 | 3.11E-04 | 8.89E-05 | 1.71E-07 |
| TE123 | 2.82E-16 | 3.57E-16 | 3.67E-16 | 3.67E-16 | 3.67E-16 | 3.67E-16 | 3.67E-16 |
| TE123M | 2.60E-03 | 3.13E-04 | 6.63E-08 | 1.69E-12 | 1.10E-21 | | |
| TE125M | 8.12E-03 | 8.76E-03 | 3.23E-03 | 9.25E-04 | 7.58E-05 | 2.17E-05 | 4.16E-08 |
| TE127 | 2.90E-10 | 1.72E-12 | 1.59E-16 | 1.43E-21 | | | |
| TE127M | 1.79E-11 | 1.75E-12 | 1.62E-16 | 1.46E-21 | | | |
| TL206 | 1.65E-07 | 1.65E-07 | 1.65E-07 | 1.65E-07 | 1.65E-07 | 1.65E-07 | 1.65E-07 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 2.21E-05 | 2.21E-05 | 2.21E-05 | 2.21E-05 | 2.21E-05 | 2.21E-05 | 2.21E-05 |
| BI210M | 1.66E-07 | 1.66E-07 | 1.66E-07 | 1.66E-07 | 1.66E-07 | 1.66E-07 | 1.66E-07 |
| PO210 | 8.97E-01 | 1.51E-01 | 1.00E-04 | 1.14E-08 | 6.64E-10 | 6.65E-10 | 6.64E-10 |
| Specific Activity Total | 4.15E+03 | 2.31E+01 | 7.49E-01 | 3.54E-01 | 3.29E-01 | 3.20E-01 | 2.79E-01 |
| Total Activity (Curies) | 2.59E+03 | 1.44E+01 | 4.67E-01 | 2.20E-01 | 2.05E-01 | 1.99E-01 | 1.74E-01 |

## Lead Specific Activity (µCi/gm)

Part: #43 Weight: 2.91E+06 gms Flux: 1.20E+12 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| | Years after shutdown | | | | | | |
| CO 60 | 5.16E-26 | 5.29E-25 | 5.29E-25 | 5.29E-25 | 5.29E-25 | 5.29E-25 | 5.29E-25 |
| NI 63 | 1.69E-07 | 1.67E-07 | 1.62E-07 | 1.56E-07 | 1.45E-07 | 1.39E-07 | 1.16E-07 |
| ZN 65 | 1.02E+00 | 3.60E-01 | 5.67E-03 | 3.16E-05 | 9.78E-10 | 5.44E-12 | 2.91E-23 |
| AG108 | 6.41E+02 | 2.38E-02 | 2.33E-02 | 2.27E-02 | 2.15E-02 | 2.09E-02 | 1.82E-02 |
| AG108M | 2.69E-01 | 2.68E-01 | 2.62E-01 | 2.55E-01 | 2.41E-01 | 2.35E-01 | 2.05E-01 |
| AG109M | 1.09E-02 | 2.71E-03 | 3.06E-04 | 2.00E-05 | 8.54E-08 | 5.58E-09 | 6.65E-15 |
| AG110 | 1.55E+03 | 2.22E-01 | 3.86E-03 | 2.44E-05 | 9.70E-10 | 6.12E-12 | 6.12E-23 |
| AG110M | 4.61E+01 | 1.67E+01 | 2.91E-01 | 1.83E-03 | 7.30E-08 | 4.60E-10 | 4.60E-21 |
| CD109 | 4.68E-03 | 2.71E-03 | 3.06E-04 | 2.00E-05 | 8.54E-08 | 5.58E-09 | 6.65E-15 |
| IN113M | 1.69E-01 | 1.87E-02 | 2.83E-06 | 4.74E-11 | 1.33E-20 | 2.22E-25 | |
| SN113 | 1.69E-01 | 1.87E-02 | 2.83E-06 | 4.73E-11 | 1.33E-20 | 2.22E-25 | |
| SN119M | 5.73E-02 | 2.04E-02 | 3.27E-04 | 1.86E-06 | 6.07E-11 | 3.46E-13 | 2.09E-24 |
| SN121M | 9.70E-05 | 9.56E-05 | 9.05E-05 | 8.44E-05 | 7.35E-05 | 6.85E-05 | 4.85E-05 |
| SN123 | 1.68E-01 | 2.36E-02 | 9.30E-06 | 5.16E-10 | 1.59E-18 | 8.79E-23 | |
| SB124 | 4.33E+01 | 6.46E-01 | 3.19E-08 | 2.35E-17 | | | |
| SB125 | 3.69E-02 | 2.88E-02 | 1.06E-02 | 3.03E-03 | 2.48E-04 | 7.09E-05 | 1.36E-07 |
| TE123 | 1.81E-16 | 2.29E-16 | 2.35E-16 | 2.35E-16 | 2.35E-16 | 2.35E-16 | 2.35E-16 |
| TE123M | 1.66E-03 | 2.01E-04 | 4.24E-08 | 1.08E-12 | 7.02E-22 | | |
| TE125M | 6.47E-03 | 6.99E-03 | 2.58E-03 | 7.38E-04 | 6.04E-05 | 1.73E-05 | 3.32E-08 |
| TE127 | 1.48E-10 | 8.76E-13 | 8.09E-17 | 7.32E-22 | | | |
| TE127M | 9.13E-12 | 8.95E-13 | 8.26E-17 | 7.47E-22 | | | |
| TL206 | 1.32E-07 | 1.32E-07 | 1.32E-07 | 1.32E-07 | 1.32E-07 | 1.32E-07 | 1.32E-07 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 |
| BI210M | 1.33E-07 | 1.33E-07 | 1.33E-07 | 1.33E-07 | 1.33E-07 | 1.33E-07 | 1.33E-07 |
| PO210 | 7.18E-01 | 1.21E-01 | 8.02E-05 | 9.10E-09 | 5.32E-10 | 5.32E-10 | 5.32E-10 |
| Specific Activity Total | 3.32E+03 | 1.85E+01 | 6.00E-01 | 2.83E-01 | 2.63E-01 | 2.56E-01 | 2.23E-01 |
| Total Activity (Curies) | 9.67E+03 | 5.38E+01 | 1.74E+00 | 8.24E-01 | 7.65E-01 | 7.44E-01 | 6.49E-01 |

Lead Specific Activity (µCi/gm)

Part: #44 Weight: 1.80E+05 gms Flux: 1.00E+12 $\frac{neutrons}{cm^2 - second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| NI 63 | 1.40E-07 | 1.39E-07 | 1.35E-07 | 1.30E-07 | 1.21E-07 | 1.16E-07 | 9.63E-08 |
| ZN 65 | 8.48E-01 | 3.00E-01 | 4.72E-03 | 2.63E-05 | 8.15E-10 | 4.54E-12 | 2.43E-23 |
| AG108 | 5.34E+02 | 1.98E-02 | 1.94E-02 | 1.89E-02 | 1.79E-02 | 1.74E-02 | 1.52E-02 |
| AG108M | 2.24E-01 | 2.23E-01 | 2.18E-01 | 2.12E-01 | 2.01E-01 | 1.96E-01 | 1.71E-01 |
| AG109M | 7.54E-03 | 1.89E-03 | 2.13E-04 | 1.39E-05 | 5.94E-08 | 3.88E-09 | 4.62E-15 |
| AG110 | 1.29E+03 | 1.85E-01 | 3.22E-03 | 2.03E-05 | 8.09E-10 | 5.11E-12 | 5.10E-23 |
| AG110M | 3.84E+01 | 1.39E+01 | 2.42E-01 | 1.53E-03 | 6.09E-08 | 3.84E-10 | 3.84E-21 |
| CD109 | 3.26E-03 | 1.89E-03 | 2.13E-04 | 1.39E-05 | 5.93E-08 | 3.88E-09 | 4.62E-15 |
| IN113M | 1.41E-01 | 1.56E-02 | 2.36E-06 | 3.95E-11 | 1.11E-20 | 1.85E-25 | |
| SN113 | 1.41E-01 | 1.56E-02 | 2.36E-06 | 3.94E-11 | 1.11E-20 | 1.85E-25 | |
| SN119M | 4.77E-02 | 1.70E-02 | 2.72E-04 | 1.55E-06 | 5.06E-11 | 2.88E-13 | 1.74E-24 |
| SN121M | 8.08E-05 | 7.97E-05 | 7.54E-05 | 7.03E-05 | 6.12E-05 | 5.71E-05 | 4.04E-05 |
| SN123 | 1.40E-01 | 1.97E-02 | 7.75E-06 | 4.30E-10 | 1.32E-18 | 7.33E-23 | |
| SB124 | 3.61E+01 | 5.38E-01 | 2.66E-08 | 1.96E-17 | | | |
| SB125 | 3.07E-02 | 2.39E-02 | 8.80E-03 | 2.52E-03 | 2.06E-04 | 5.90E-05 | 1.14E-07 |
| TE123 | 1.25E-16 | 1.59E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 |
| TE123M | 1.15E-03 | 1.39E-04 | 2.94E-08 | 7.50E-13 | 4.87E-22 | | |
| TE125M | 5.38E-03 | 5.81E-03 | 2.15E-03 | 6.14E-04 | 5.03E-05 | 1.44E-05 | 2.77E-08 |
| TE127 | 8.54E-11 | 5.06E-13 | 4.67E-17 | 4.23E-22 | | | |
| TE127M | 5.27E-12 | 5.16E-13 | 4.77E-17 | 4.31E-22 | | | |
| TL206 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 |
| BI210M | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 |
| PO210 | 5.98E-01 | 1.01E-01 | 6.68E-05 | 7.58E-09 | 4.43E-10 | 4.43E-10 | 4.43E-10 |
| Specific Activity Total | 2.77E+03 | 1.54E+01 | 5.00E-01 | 2.36E-01 | 2.19E-01 | 2.13E-01 | 1.86E-01 |
| Total Activity (Curies) | 4.99E+02 | 2.78E+00 | 8.99E-02 | 4.25E-02 | 3.95E-02 | 3.84E-02 | 3.35E-02 |

Lead Specific Activity (μCi/gm)

Part: #45 Weight: 8.29E+05 gms Flux: 1.00E+12 $\frac{neutrons}{cm^2\text{-}second}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| NI 63 | 1.40E-07 | 1.39E-07 | 1.35E-07 | 1.30E-07 | 1.21E-07 | 1.16E-07 | 9.63E-08 |
| ZN 65 | 8.48E-01 | 3.00E-01 | 4.72E-03 | 2.63E-05 | 8.15E-10 | 4.54E-12 | 2.43E-23 |
| AG108 | 5.34E+02 | 1.98E-02 | 1.94E-02 | 1.89E-02 | 1.79E-02 | 1.74E-02 | 1.52E-02 |
| AG108M | 2.24E-01 | 2.23E-01 | 2.18E-01 | 2.12E-01 | 2.01E-01 | 1.96E-01 | 1.71E-01 |
| AG109M | 7.54E-03 | 1.89E-03 | 2.13E-04 | 1.39E-05 | 5.94E-08 | 3.88E-09 | 4.62E-15 |
| AG110 | 1.29E+03 | 1.85E-01 | 3.22E-03 | 2.03E-05 | 8.09E-10 | 5.11E-12 | 5.10E-23 |
| AG110M | 3.84E+01 | 1.39E+01 | 2.42E-01 | 1.53E-03 | 6.09E-08 | 3.84E-10 | 3.84E-21 |
| CD109 | 3.26E-03 | 1.89E-03 | 2.13E-04 | 1.39E-05 | 5.93E-08 | 3.88E-09 | 4.62E-15 |
| IN113M | 1.41E-01 | 1.56E-02 | 2.36E-06 | 3.95E-11 | 1.11E-20 | 1.85E-25 | |
| SN113 | 1.41E-01 | 1.56E-02 | 2.36E-06 | 3.94E-11 | 1.11E-20 | 1.85E-25 | |
| SN119M | 4.77E-02 | 1.70E-02 | 2.72E-04 | 1.55E-06 | 5.06E-11 | 2.88E-13 | 1.74E-24 |
| SN121M | 8.08E-05 | 7.97E-05 | 7.54E-05 | 7.03E-05 | 6.12E-05 | 5.71E-05 | 4.04E-05 |
| SN123 | 1.40E-01 | 1.97E-02 | 7.75E-06 | 4.30E-10 | 1.32E-18 | 7.33E-23 | |
| SB124 | 3.61E+01 | 5.38E-01 | 2.66E-08 | 1.96E-17 | | | |
| SB125 | 3.07E-02 | 2.39E-02 | 8.80E-03 | 2.52E-03 | 2.06E-04 | 5.90E-05 | 1.14E-07 |
| TE123 | 1.25E-16 | 1.59E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 |
| TE123M | 1.15E-03 | 1.39E-04 | 2.94E-08 | 7.50E-13 | 4.87E-22 | | |
| TE125M | 5.38E-03 | 5.81E-03 | 2.15E-03 | 6.14E-04 | 5.03E-05 | 1.44E-05 | 2.77E-08 |
| TE127 | 8.54E-11 | 5.06E-13 | 4.67E-17 | 4.23E-22 | | | |
| TE127M | 5.27E-12 | 5.16E-13 | 4.77E-17 | 4.31E-22 | | | |
| TL206 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 | 1.10E-07 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 |
| BI210M | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 | 1.11E-07 |
| PO210 | 5.98E-01 | 1.01E-01 | 6.68E-05 | 7.58E-09 | 4.43E-10 | 4.43E-10 | 4.43E-10 |
| Specific Activity Total | 2.77E+03 | 1.54E+01 | 5.00E-01 | 2.36E-01 | 2.19E-01 | 2.13E-01 | 1.86E-01 |
| Total Activity (Curies) | 2.30E+03 | 1.28E+01 | 4.14E-01 | 1.96E-01 | 1.82E-01 | 1.77E-01 | 1.54E-01 |

| Lead Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #46 | Weight: 9.29E+06 gms | | Flux: 5.00E+11 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| NI 63 | 7.01E-08 | 6.96E-08 | 6.75E-08 | 6.50E-08 | 6.03E-08 | 5.81E-08 | 4.81E-08 |
| ZN 65 | 4.24E-01 | 1.50E-01 | 2.36E-03 | 1.31E-05 | 4.07E-10 | 2.27E-12 | 1.21E-23 |
| AG108 | 2.67E+02 | 9.92E-03 | 9.71E-03 | 9.45E-03 | 8.95E-03 | 8.70E-03 | 7.60E-03 |
| AG108M | 1.12E-01 | 1.12E-01 | 1.09E-01 | 1.06E-01 | 1.01E-01 | 9.78E-02 | 8.53E-02 |
| AG109M | 1.89E-03 | 4.73E-04 | 5.34E-05 | 3.49E-06 | 1.49E-08 | 9.72E-10 | 1.16E-15 |
| AG110 | 6.46E+02 | 9.29E-02 | 1.61E-03 | 1.02E-05 | 4.05E-10 | 2.56E-12 | 2.56E-23 |
| AG110M | 1.92E+01 | 6.99E+00 | 1.21E-01 | 7.66E-04 | 3.05E-08 | 1.92E-10 | 1.92E-21 |
| CD109 | 8.16E-04 | 4.73E-04 | 5.34E-05 | 3.49E-06 | 1.49E-08 | 9.72E-10 | 1.16E-15 |
| IN113M | 7.04E-02 | 7.80E-03 | 1.18E-06 | 1.97E-11 | 5.53E-21 | 9.26E-26 | |
| SN113 | 7.03E-02 | 7.80E-03 | 1.18E-06 | 1.97E-11 | 5.53E-21 | 9.26E-26 | |
| SN119M | 2.38E-02 | 8.49E-03 | 1.36E-04 | 7.77E-07 | 2.53E-11 | 1.44E-13 | 8.72E-25 |
| SN121M | 4.04E-05 | 3.98E-05 | 3.77E-05 | 3.52E-05 | 3.06E-05 | 2.86E-05 | 2.02E-05 |
| SN123 | 6.99E-02 | 9.85E-03 | 3.88E-06 | 2.15E-10 | 6.61E-19 | 3.66E-23 | |
| SB124 | 1.80E+01 | 2.69E-01 | 1.33E-08 | 9.80E-18 | | | |
| SB125 | 1.53E-02 | 1.19E-02 | 4.38E-03 | 1.25E-03 | 1.03E-04 | 2.94E-05 | 5.63E-08 |
| TE123 | 3.14E-17 | 3.98E-17 | 4.09E-17 | 4.09E-17 | 4.09E-17 | 4.09E-17 | 4.09E-17 |
| TE123M | 2.89E-04 | 3.48E-05 | 7.36E-09 | 1.88E-13 | 1.22E-22 | | |
| TE125M | 2.67E-03 | 2.89E-03 | 1.07E-03 | 3.06E-04 | 2.50E-05 | 7.16E-06 | 1.38E-08 |
| TE127 | 1.06E-11 | 6.29E-14 | 5.80E-18 | 5.25E-23 | | | |
| TE127M | 6.55E-13 | 6.42E-14 | 5.92E-18 | 5.36E-23 | | | |
| TL206 | 5.52E-08 | 5.52E-08 | 5.52E-08 | 5.52E-08 | 5.52E-08 | 5.52E-08 | 5.52E-08 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 7.37E-06 | 7.37E-06 | 7.37E-06 | 7.37E-06 | 7.37E-06 | 7.37E-06 | 7.37E-06 |
| BI210M | 5.54E-08 | 5.54E-08 | 5.54E-08 | 5.54E-08 | 5.54E-08 | 5.54E-08 | 5.54E-08 |
| PO210 | 2.99E-01 | 5.03E-02 | 3.34E-05 | 3.79E-09 | 2.22E-10 | 2.22E-10 | 2.22E-10 |
| Specific Activity Total | 1.39E+03 | 7.72E+00 | 2.50E-01 | 1.18E-01 | 1.10E-01 | 1.07E-01 | 9.30E-02 |
| Total Activity (Curies) | 1.29E+04 | 7.17E+01 | 2.32E+00 | 1.10E+00 | 1.02E+00 | 9.90E-01 | 8.64E-01 |

Lead Specific Activity (μCi/gm) $\frac{neutrons}{cm^2\text{-}second}$

Part: #47 Weight: 1.35E+07 gms Flux: 2.00E+11

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| NI 63 | 2.80E-08 | 2.78E-08 | 2.70E-08 | 2.60E-08 | 2.41E-08 | 2.32E-08 | 1.92E-08 |
| ZN 65 | 1.69E-01 | 6.00E-02 | 9.43E-04 | 5.25E-06 | 1.63E-10 | 9.06E-13 | 4.85E-24 |
| AG108 | 1.07E+02 | 3.97E-03 | 3.88E-03 | 3.78E-03 | 3.58E-03 | 3.48E-03 | 3.04E-03 |
| AG108M | 4.49E-02 | 4.46E-02 | 4.36E-02 | 4.25E-02 | 4.02E-02 | 3.91E-02 | 3.41E-02 |
| AG109M | 3.02E-04 | 7.58E-05 | 8.55E-06 | 5.59E-07 | 2.38E-09 | 1.56E-10 | 1.86E-16 |
| AG110 | 2.59E+02 | 3.72E-02 | 6.46E-04 | 4.08E-06 | 1.62E-10 | 1.02E-12 | 1.02E-23 |
| AG110M | 7.70E+00 | 2.80E+00 | 4.86E-02 | 3.07E-04 | 1.22E-08 | 7.70E-11 | 7.69E-22 |
| CD109 | 1.31E-04 | 7.58E-05 | 8.55E-06 | 5.59E-07 | 2.38E-09 | 1.56E-10 | 1.86E-16 |
| IN113M | 2.82E-02 | 3.12E-03 | 4.72E-07 | 7.89E-12 | 2.21E-21 | | |
| SN113 | 2.81E-02 | 3.12E-03 | 4.71E-07 | 7.89E-12 | 2.21E-21 | | |
| SN119M | 9.54E-03 | 3.40E-03 | 5.44E-05 | 3.11E-07 | 1.01E-11 | 5.77E-14 | 3.49E-25 |
| SN121M | 1.62E-05 | 1.59E-05 | 1.51E-05 | 1.41E-05 | 1.22E-05 | 1.14E-05 | 8.08E-06 |
| SN123 | 2.80E-02 | 3.94E-03 | 1.55E-06 | 8.60E-11 | 2.64E-19 | 1.46E-23 | |
| SB124 | 7.22E+00 | 1.08E-01 | 5.32E-09 | 3.92E-18 | | | |
| SB125 | 6.11E-03 | 4.76E-03 | 1.75E-03 | 5.01E-04 | 4.10E-05 | 1.17E-05 | 2.24E-08 |
| TE123 | 5.03E-18 | 6.36E-18 | 6.55E-18 | 6.55E-18 | 6.55E-18 | 6.55E-18 | 6.55E-18 |
| TE123M | 4.62E-05 | 5.57E-06 | 1.18E-09 | 3.00E-14 | 1.95E-23 | | |
| TE125M | 1.07E-03 | 1.16E-03 | 4.27E-04 | 1.22E-04 | 1.00E-05 | 2.86E-06 | 5.49E-09 |
| TE127 | 6.76E-13 | 4.01E-15 | 3.70E-19 | 3.35E-24 | | | |
| TE127M | 4.18E-14 | 4.09E-15 | 3.78E-19 | 3.42E-24 | | | |
| TL206 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 2.95E-06 | 2.95E-06 | 2.95E-06 | 2.95E-06 | 2.95E-06 | 2.95E-06 | 2.95E-06 |
| BI210M | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 | 2.21E-08 |
| PO210 | 1.20E-01 | 2.01E-02 | 1.34E-05 | 1.52E-09 | 8.86E-11 | 8.86E-11 | 8.86E-11 |
| Specific Activity Total | 5.55E+02 | 3.09E+00 | 1.00E-01 | 4.72E-02 | 4.39E-02 | 4.26E-02 | 3.72E-02 |
| Total Activity (Curies) | 7.49E+03 | 4.17E+01 | 1.35E+00 | 6.37E-01 | 5.92E-01 | 5.76E-01 | 5.02E-01 |

Lead Specific Activity (μCi/gm)

Part: #48 Weight: 4.47E+06 gms Flux: 1.00E+11 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| NI 63 | 1.40E-08 | 1.39E-08 | 1.35E-08 | 1.30E-08 | 1.21E-08 | 1.16E-08 | 9.62E-09 |
| ZN 65 | 8.47E-02 | 3.00E-02 | 4.71E-04 | 2.62E-06 | 8.13E-11 | 4.53E-13 | 2.42E-24 |
| AG108 | 5.35E+01 | 1.98E-03 | 1.94E-03 | 1.89E-03 | 1.79E-03 | 1.74E-03 | 1.52E-03 |
| AG108M | 2.24E-02 | 2.23E-02 | 2.18E-02 | 2.12E-02 | 2.01E-02 | 1.96E-02 | 1.71E-02 |
| AG109M | 7.56E-05 | 1.90E-05 | 2.14E-06 | 1.40E-07 | 5.97E-10 | 3.90E-11 | 4.65E-17 |
| AG110 | 1.29E+02 | 1.86E-02 | 3.23E-04 | 2.04E-06 | 8.12E-11 | 5.12E-13 | 5.12E-24 |
| AG110M | 3.85E+00 | 1.40E+00 | 2.43E-02 | 1.53E-04 | 6.11E-09 | 3.85E-11 | 3.85E-22 |
| CD109 | 3.27E-05 | 1.90E-05 | 2.14E-06 | 1.40E-07 | 5.97E-10 | 3.90E-11 | 4.65E-17 |
| IN113M | 1.41E-02 | 1.56E-03 | 2.36E-07 | 3.95E-12 | 1.11E-21 | | |
| SN113 | 1.41E-02 | 1.56E-03 | 2.36E-07 | 3.94E-12 | 1.11E-21 | | |
| SN119M | 4.77E-03 | 1.70E-03 | 2.72E-05 | 1.55E-07 | 5.06E-12 | 2.88E-14 | 1.75E-25 |
| SN121M | 8.08E-06 | 7.97E-06 | 7.54E-06 | 7.03E-06 | 6.12E-06 | 5.71E-06 | 4.04E-06 |
| SN123 | 1.40E-02 | 1.97E-03 | 7.75E-07 | 4.30E-11 | 1.32E-19 | 7.32E-24 | |
| SB124 | 3.61E+00 | 5.38E-02 | 2.66E-09 | 1.96E-18 | | | |
| SB125 | 3.05E-03 | 2.38E-03 | 8.74E-04 | 2.50E-04 | 2.05E-05 | 5.86E-06 | 1.13E-08 |
| TE123 | 1.26E-18 | 1.59E-18 | 1.64E-18 | 1.64E-18 | 1.64E-18 | 1.64E-18 | 1.64E-18 |
| TE123M | 1.15E-05 | 1.39E-06 | 2.94E-10 | 7.50E-15 | 4.87E-24 | | |
| TE125M | 5.33E-04 | 5.77E-04 | 2.13E-04 | 6.10E-05 | 5.00E-06 | 1.43E-06 | 2.75E-09 |
| TE127 | 8.44E-14 | 5.01E-16 | 4.62E-20 | 4.18E-25 | | | |
| TE127M | 5.21E-15 | 5.11E-16 | 4.72E-20 | 4.27E-25 | | | |
| TL206 | 1.10E-08 | 1.10E-08 | 1.10E-08 | 1.10E-08 | 1.10E-08 | 1.10E-08 | 1.10E-08 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 1.48E-06 | 1.48E-06 | 1.48E-06 | 1.48E-06 | 1.48E-06 | 1.48E-06 | 1.48E-06 |
| BI210M | 1.11E-08 | 1.11E-08 | 1.11E-08 | 1.11E-08 | 1.11E-08 | 1.11E-08 | 1.11E-08 |
| PO210 | 5.98E-02 | 1.00E-02 | 6.68E-06 | 7.58E-10 | 4.43E-11 | 4.43E-11 | 4.43E-11 |
| Specific Activity Total | 2.78E+02 | 1.55E+00 | 5.00E-02 | 2.36E-02 | 2.19E-02 | 2.13E-02 | 1.86E-02 |
| Total Activity (Curies) | 1.24E+03 | 6.91E+00 | 2.24E-01 | 1.05E-01 | 9.80E-02 | 9.53E-02 | 8.31E-02 |

## Lead Specific Activity (µCi/gm)

Part: #49 Weight: 1.65E+06 gms Flux: 1.00E+08 $\frac{\text{neutrons}}{\text{cm}^2\text{-second}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| NI 63 | 1.40E-11 | 1.39E-11 | 1.35E-11 | 1.30E-11 | 1.20E-11 | 1.16E-11 | 9.62E-12 |
| ZN 65 | 8.46E-05 | 3.00E-05 | 4.71E-07 | 2.62E-09 | 8.13E-14 | 4.53E-16 | |
| AG108 | 5.35E-02 | 1.99E-06 | 1.94E-06 | 1.89E-06 | 1.79E-06 | 1.74E-06 | 1.52E-06 |
| AG108M | 2.24E-05 | 2.23E-05 | 2.18E-05 | 2.12E-05 | 2.01E-05 | 1.96E-05 | 1.71E-05 |
| AG109M | 7.56E-11 | 1.90E-11 | 2.14E-12 | 1.40E-13 | 5.97E-16 | 3.90E-17 | 4.65E-23 |
| AG110 | 1.29E-01 | 1.86E-05 | 3.23E-07 | 2.04E-09 | 8.12E-14 | 5.13E-16 | |
| AG110M | 3.85E-03 | 1.40E-03 | 2.43E-05 | 1.53E-07 | 6.11E-12 | 3.85E-14 | 3.85E-25 |
| CD109 | 3.28E-11 | 1.90E-11 | 2.14E-12 | 1.40E-13 | 5.97E-16 | 3.90E-17 | 4.65E-23 |
| IN113M | 1.41E-05 | 1.56E-06 | 2.36E-10 | 3.95E-15 | 1.11E-24 | | |
| SN113 | 1.41E-05 | 1.56E-06 | 2.36E-10 | 3.95E-15 | 1.11E-24 | | |
| SN119M | 4.77E-06 | 1.70E-06 | 2.72E-08 | 1.55E-10 | 5.06E-15 | 2.88E-17 | |
| SN121M | 8.08E-09 | 7.97E-09 | 7.54E-09 | 7.03E-09 | 6.12E-09 | 5.71E-09 | 4.04E-09 |
| SN123 | 1.40E-05 | 1.97E-06 | 7.75E-10 | 4.30E-14 | 1.32E-22 | | |
| SB124 | 3.61E-03 | 5.38E-05 | 2.66E-12 | 1.96E-21 | | | |
| SB125 | 3.05E-06 | 2.38E-06 | 8.73E-07 | 2.50E-07 | 2.05E-08 | 5.86E-09 | 1.12E-11 |
| TE123 | 1.39E-24 | 1.75E-24 | 1.80E-24 | 1.80E-24 | 1.80E-24 | 1.80E-24 | 1.80E-24 |
| TE123M | 1.26E-11 | 1.52E-12 | 3.22E-16 | 8.20E-21 | | | |
| TE125M | 5.32E-07 | 5.77E-07 | 2.13E-07 | 6.10E-08 | 4.99E-09 | 1.43E-09 | 2.74E-12 |
| TL206 | 1.10E-11 | 1.10E-11 | 1.10E-11 | 1.10E-11 | 1.10E-11 | 1.10E-11 | 1.10E-11 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 |
| BI210M | 1.11E-11 | 1.11E-11 | 1.11E-11 | 1.11E-11 | 1.11E-11 | 1.11E-11 | 1.11E-11 |
| PO210 | 5.98E-05 | 1.01E-05 | 6.68E-09 | 7.58E-13 | 4.43E-14 | 4.43E-14 | 4.43E-14 |
| Specific Activity Total | 2.78E-01 | 1.55E-03 | 5.00E-05 | 2.36E-05 | 2.19E-05 | 2.13E-05 | 1.86E-05 |
| Total Activity (Curies) | 4.58E-01 | 2.55E-03 | 8.25E-05 | 3.89E-05 | 3.62E-05 | 3.52E-05 | 3.07E-05 |

| Lead Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #80 | Weight: 1.71E+04 gms | | Flux: 3.10E+10 $\frac{neutrons}{cm^2 - second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| NI 63 | 4.34E-09 | 4.31E-09 | 4.18E-09 | 4.03E-09 | 3.74E-09 | 3.60E-09 | 2.98E-09 |
| ZN 65 | 2.62E-02 | 9.29E-03 | 1.46E-04 | 8.14E-07 | 2.52E-11 | 1.40E-13 | 7.51E-25 |
| AG108 | 1.66E+01 | 6.15E-04 | 6.02E-04 | 5.86E-04 | 5.55E-04 | 5.40E-04 | 4.71E-04 |
| AG108M | 6.95E-03 | 6.91E-03 | 6.77E-03 | 6.58E-03 | 6.23E-03 | 6.07E-03 | 5.29E-03 |
| AG109M | 7.26E-06 | 1.82E-06 | 2.06E-07 | 1.34E-08 | 5.74E-11 | 3.75E-12 | 4.47E-18 |
| AG110 | 4.01E+01 | 5.77E-03 | 1.00E-04 | 6.33E-07 | 2.52E-11 | 1.59E-13 | 1.59E-24 |
| AG110M | 1.20E+00 | 4.34E-01 | 7.54E-03 | 4.76E-05 | 1.89E-09 | 1.19E-11 | 1.19E-22 |
| CD109 | 3.15E-06 | 1.82E-06 | 2.06E-07 | 1.34E-08 | 5.74E-11 | 3.75E-12 | 4.47E-18 |
| IN113M | 4.36E-03 | 4.84E-04 | 7.31E-08 | 1.22E-12 | 3.43E-22 | | |
| SN113 | 4.36E-03 | 4.84E-04 | 7.30E-08 | 1.22E-12 | 3.43E-22 | | |
| SN119M | 1.48E-03 | 5.26E-04 | 8.44E-06 | 4.81E-08 | 1.57E-12 | 8.94E-15 | 5.41E-26 |
| SN121M | 2.51E-06 | 2.47E-06 | 2.34E-06 | 2.18E-06 | 1.90E-06 | 1.77E-06 | 1.25E-06 |
| SN123 | 4.34E-03 | 6.11E-04 | 2.40E-07 | 1.33E-11 | 4.10E-20 | 2.27E-24 | |
| SB124 | 1.12E+00 | 1.67E-02 | 8.24E-10 | 6.07E-19 | | | |
| SB125 | 9.45E-04 | 7.37E-04 | 2.71E-04 | 7.75E-05 | 6.35E-06 | 1.82E-06 | 3.48E-09 |
| TE123 | 1.33E-19 | 1.67E-19 | 1.72E-19 | 1.72E-19 | 1.72E-19 | 1.72E-19 | 1.72E-19 |
| TE123M | 1.20E-06 | 1.45E-07 | 3.07E-11 | 7.82E-16 | 5.08E-25 | | |
| TE125M | 1.65E-04 | 1.79E-04 | 6.61E-05 | 1.89E-05 | 1.55E-06 | 4.43E-07 | 8.50E-10 |
| TL206 | 3.42E-09 | 3.42E-09 | 3.42E-09 | 3.42E-09 | 3.42E-09 | 3.42E-09 | 3.42E-09 |
| PB204 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| PB205 | 4.57E-07 | 4.57E-07 | 4.57E-07 | 4.57E-07 | 4.57E-07 | 4.57E-07 | 4.57E-07 |
| BI210M | 3.43E-09 | 3.43E-09 | 3.43E-09 | 3.43E-09 | 3.43E-09 | 3.43E-09 | 3.43E-09 |
| PO210 | 1.85E-02 | 3.12E-03 | 2.07E-06 | 2.35E-10 | 1.37E-11 | 1.37E-11 | 1.37E-11 |
| Specific Activity Total | 8.60E+01 | 4.79E-01 | 1.55E-02 | 7.32E-03 | 6.80E-03 | 6.61E-03 | 5.77E-03 |
| Total Activity (Curies) | 1.47E+00 | 8.19E-03 | 2.65E-04 | 1.25E-04 | 1.16E-04 | 1.13E-04 | 9.86E-05 |

| Cadmium Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #14 | Weight: 5.36E+04 gms | | Flux: 2.10E+13 $\frac{neutrons}{cm^2\text{-}second}$ | | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| FE 55 | 8.34E+01 | 6.39E+01 | 2.20E+01 | 5.80E+00 | 4.03E-01 | 1.06E-01 | 1.36E-04 |
| FE 59 | 1.02E+01 | 3.68E-02 | 6.20E-12 | 3.76E-24 | | | |
| CO 60 | 8.27E-03 | 7.25E-03 | 4.29E-03 | 2.22E-03 | 5.96E-04 | 3.09E-04 | 1.15E-05 |
| NI 63 | 9.75E-05 | 9.67E-05 | 9.39E-05 | 9.04E-05 | 8.39E-05 | 8.07E-05 | 6.69E-05 |
| ZN 65 | 5.93E+02 | 2.10E+02 | 3.30E+00 | 1.84E-02 | 5.70E-07 | 3.17E-09 | 1.70E-20 |
| AG108 | 5.57E+04 | 2.08E+00 | 2.03E+00 | 1.98E+00 | 1.87E+00 | 1.82E+00 | 1.59E+00 |
| AG108M | 2.35E+01 | 2.33E+01 | 2.28E+01 | 2.22E+01 | 2.10E+01 | 2.05E+01 | 1.79E+01 |
| AG109M | 9.54E+03 | 5.52E+03 | 6.23E+02 | 4.07E+01 | 1.74E-01 | 1.14E-02 | 1.35E-08 |
| AG110 | 1.29E+05 | 1.82E+01 | 3.16E-01 | 2.00E-03 | 7.95E-08 | 5.01E-10 | 5.01E-21 |
| AG110M | 3.77E+03 | 1.37E+03 | 2.38E+01 | 1.50E-01 | 5.97E-06 | 3.77E-08 | 3.77E-19 |
| CD109 | 9.53E+03 | 5.52E+03 | 6.23E+02 | 4.07E+01 | 1.74E-01 | 1.14E-02 | 1.35E-08 |
| CD115M | 4.42E+04 | 1.51E+02 | 2.08E-08 | 9.76E-21 | | | |
| IN115 | 4.01E-11 | 5.09E-11 | 5.09E-11 | 5.09E-11 | 5.09E-11 | 5.09E-11 | 5.09E-11 |
| SN119M | 3.01E-05 | 1.07E-05 | 1.72E-07 | 9.80E-10 | 3.19E-14 | 1.82E-16 | |
| SN121M | 2.60E-18 | 2.56E-18 | 2.43E-18 | 2.26E-18 | 1.97E-18 | 1.84E-18 | 1.30E-18 |
| TL206 | 1.87E-11 | 6.98E-13 | 6.98E-13 | 6.98E-13 | 6.98E-13 | 6.98E-13 | 6.98E-13 |
| PB204 | 3.45E-13 | 3.45E-13 | 3.45E-13 | 3.45E-13 | 3.45E-13 | 3.45E-13 | 3.45E-13 |
| PB205 | 6.20E-07 | 6.20E-07 | 6.20E-07 | 6.20E-07 | 6.20E-07 | 6.20E-07 | 6.20E-07 |
| BI210M | 7.00E-13 | 7.00E-13 | 7.00E-13 | 7.00E-13 | 7.00E-13 | 7.00E-13 | 7.00E-13 |
| PO210 | 4.55E-06 | 7.87E-07 | 5.23E-10 | 5.87E-14 | 2.80E-15 | 2.80E-15 | 2.80E-15 |
| Specific Activity Total | 7.57E+05 | 1.29E+04 | 1.32E+03 | 1.12E+02 | 2.37E+01 | 2.24E+01 | 1.94E+01 |
| Total Activity (Curies) | 4.05E+04 | 6.91E+02 | 7.08E+01 | 5.98E+00 | 1.27E+00 | 1.20E+00 | 1.04E+00 |

| Barytes Concrete Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #90 | Weight: 1.97E+06 gms | | | Flux: 1.00E+05 $\frac{neutrons}{cm^2\text{-}seconds}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.17E-07 | 1.10E-07 | 8.80E-08 | 6.65E-08 | 3.79E-08 | 2.86E-08 | 7.04E-09 |
| C 14 | 3.19E-10 | 3.18E-10 | 3.18E-10 | 3.18E-10 | 3.18E-10 | 3.18E-10 | 3.17E-10 |
| S 35 | 4.93E-05 | 2.78E-06 | 2.79E-11 | 1.58E-17 | | | |
| CL 36 | 3.21E-21 | 3.21E-21 | 3.21E-21 | 3.21E-21 | 3.21E-21 | 3.21E-21 | 3.21E-21 |
| CA 41 | 5.75E-09 | 5.75E-09 | 5.75E-09 | 5.75E-09 | 5.75E-09 | 5.75E-09 | 5.75E-09 |
| CA 45 | 3.07E-05 | 6.49E-06 | 1.30E-08 | 5.50E-12 | 9.84E-19 | 4.16E-22 | |
| FE 55 | 3.58E-05 | 2.74E-05 | 9.44E-06 | 2.49E-06 | 1.73E-07 | 4.56E-08 | 5.84E-11 |
| CO 60 | 1.05E-05 | 9.19E-06 | 5.43E-06 | 2.82E-06 | 7.55E-07 | 3.91E-07 | 1.46E-08 |
| NI 63 | 7.80E-13 | 7.74E-13 | 7.51E-13 | 7.23E-13 | 6.71E-13 | 6.46E-13 | 5.35E-13 |
| ZN 65 | 4.71E-06 | 1.67E-06 | 2.62E-08 | 1.46E-10 | 4.53E-15 | 2.52E-17 | |
| CS134 | 1.10E-17 | 7.83E-18 | 2.05E-18 | 3.95E-19 | 1.85E-20 | 1.35E-20 | 3.03E-24 |
| BA133 | 2.94E-06 | 2.76E-06 | 2.13E-06 | 1.54E-06 | 8.09E-07 | 5.86E-07 | 1.17E-07 |
| EU152 | 3.06E-07 | 2.91E-07 | 2.37E-07 | 1.84E-07 | 1.11E-07 | 8.57E-08 | 2.39E-08 |
| EU154 | 3.44E-08 | 3.17E-08 | 2.30E-08 | 1.53E-08 | 6.86E-09 | 4.58E-09 | 6.11E-10 |
| EU155 | 1.21E-16 | 1.05E-16 | 5.99E-17 | 2.98E-17 | 7.36E-18 | 3.66E-18 | 1.16E-19 |
| GD152 | 1.63E-20 | 1.68E-20 | 1.87E-20 | 2.06E-20 | 2.32E-20 | 2.41E-20 | 2.62E-20 |
| GD153 | 3.04E-15 | 1.07E-15 | 1.63E-17 | 7.00E-20 | 2.00E-24 | 2.00E-24 | |
| IR192 | 4.44E-03 | 1.45E-04 | 4.93E-09 | 4.70E-09 | 4.57E-09 | 4.50E-09 | 4.19E-09 |
| IR192M | 4.83E-09 | 4.82E-09 | 4.76E-09 | 4.70E-09 | 4.56E-09 | 4.50E-09 | 4.19E-09 |
| PT193 | 5.73E-17 | 5.76E-17 | 5.73E-17 | 5.69E-17 | 5.61E-17 | 5.58E-17 | 5.39E-17 |
| Specific Activity Total | 7.37E-03 | 1.96E-04 | 1.74E-05 | 7.13E-06 | 1.91E-06 | 1.16E-06 | 1.77E-07 |
| Total Activity (Curies) | 1.45E-02 | 3.86E-04 | 3.43E-05 | 1.40E-05 | 3.76E-06 | 2.28E-06 | 3.49E-07 |

| Barytes Concrete Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #91 | Weight: 6.37E+05 gms | | | Flux: 4.50E+10 $\frac{neutrons}{cm^2 - seconds}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 5.24E-02 | 4.95E-02 | 3.96E-02 | 2.99E-02 | 1.71E-02 | 1.29E-02 | 3.17E-03 |
| C 14 | 1.43E-04 | 1.43E-04 | 1.43E-04 | 1.43E-04 | 1.43E-04 | 1.43E-04 | 1.42E-04 |
| SI 32 | 2.44E-13 | 2.43E-13 | 2.42E-13 | 2.41E-13 | 2.38E-13 | 2.37E-13 | 2.31E-13 |
| P 32 | 2.00E-07 | 2.47E-13 | 2.42E-13 | 2.41E-13 | 2.38E-13 | 2.37E-13 | 2.31E-13 |
| S 35 | 2.22E+01 | 1.25E+00 | 1.26E-05 | 7.10E-12 | 2.27E-24 | | |
| CL 36 | 6.50E-10 | 6.50E-10 | 6.50E-10 | 6.50E-10 | 6.50E-10 | 6.50E-10 | 6.50E-10 |
| AR 39 | 2.95E-16 | 2.94E-16 | 2.91E-16 | 2.87E-16 | 2.80E-16 | 2.76E-16 | 2.59E-16 |
| CA 41 | 2.59E-03 | 2.59E-03 | 2.59E-03 | 2.59E-03 | 2.59E-03 | 2.59E-03 | 2.59E-03 |
| CA 45 | 1.38E+01 | 2.92E+00 | 5.85E-03 | 2.47E-06 | 4.43E-13 | 1.87E-16 | |
| SC 46 | 1.52E-04 | 7.41E-06 | 4.18E-11 | 1.15E-17 | | | |
| FE 55 | 1.61E+01 | 1.23E+01 | 4.25E+00 | 1.12E+00 | 7.79E-02 | 2.05E-02 | 2.64E-05 |
| FE 59 | 1.95E+00 | 7.04E-03 | 1.19E-12 | 7.20E-25 | | | |
| CO 60 | 4.72E+00 | 4.14E+00 | 2.44E+00 | 1.27E+00 | 3.40E-01 | 1.76E-01 | 6.57E-03 |
| NI 63 | 3.51E-07 | 3.48E-07 | 3.38E-07 | 3.26E-07 | 3.02E-07 | 2.91E-07 | 2.41E-07 |
| ZN 65 | 2.12E+00 | 7.51E-01 | 1.18E-02 | 6.57E-05 | 2.04E-09 | 1.13E-11 | 6.07E-23 |
| CS134 | 2.22E-06 | 1.58E-06 | 4.13E-07 | 7.69E-08 | 2.67E-09 | 4.96E-10 | 1.11E-13 |
| CS135 | 8.83E-17 | 8.83E-17 | 8.83E-17 | 8.83E-17 | 8.83E-17 | 8.83E-17 | 8.83E-17 |
| BA133 | 1.32E+00 | 1.24E+00 | 9.55E-01 | 6.92E-01 | 3.63E-01 | 2.63E-01 | 5.23E-02 |
| SM148 | 3.62E-25 | 3.71E-25 | 3.71E-25 | 3.71E-25 | 3.71E-25 | 3.71E-25 | 3.71E-25 |
| SM149 | 3.35E-25 | 3.35E-25 | 3.35E-25 | 3.35E-25 | 3.35E-25 | 3.35E-25 | 3.35E-25 |
| SM151 | 2.02E-17 | 2.00E-17 | 1.94E-17 | 1.87E-17 | 1.73E-17 | 1.66E-17 | 1.37E-17 |
| EU152 | 1.37E-01 | 1.30E-01 | 1.06E-01 | 8.22E-02 | 4.94E-02 | 3.83E-02 | 1.07E-02 |
| EU154 | 1.55E-02 | 1.43E-02 | 1.03E-02 | 6.90E-03 | 3.08E-03 | 2.06E-03 | 2.75E-04 |
| EU155 | 2.43E-05 | 2.12E-05 | 1.21E-05 | 6.01E-06 | 1.49E-06 | 7.39E-07 | 2.24E-08 |
| GD152 | 7.21E-15 | 7.46E-15 | 8.30E-15 | 9.14E-15 | 1.03E-14 | 1.07E-14 | 1.16E-14 |
| GD153 | 6.06E-04 | 2.13E-04 | 3.24E-06 | 1.73E-08 | 4.96E-13 | 2.65E-15 | |
| OS194 | 7.53E-11 | 6.71E-11 | 4.22E-11 | 2.37E-11 | 7.47E-12 | 4.19E-12 | 2.33E-13 |
| IR192 | 1.99E+03 | 6.52E+01 | 2.22E-03 | 2.11E-03 | 2.05E-03 | 2.02E-03 | 1.88E-03 |
| IR192M | 2.17E-03 | 2.17E-03 | 2.14E-03 | 2.11E-03 | 2.05E-03 | 2.02E-03 | 1.88E-03 |
| IR194 | 4.21E+02 | 6.71E-11 | 4.23E-11 | 2.37E-11 | 7.47E-12 | 4.19E-12 | 2.33E-13 |
| PT193 | 1.15E-05 | 1.16E-05 | 1.15E-05 | 1.15E-05 | 1.13E-05 | 1.12E-05 | 1.08E-05 |
| Specific Activity Total | 3.31E+03 | 8.80E+01 | 7.83E+00 | 3.20E+00 | 8.57E-01 | 5.19E-01 | 7.96E-02 |
| Total Activity (Curies) | 2.11E+03 | 5.61E+01 | 4.99E+00 | 2.04E+00 | 5.46E-01 | 3.31E-01 | 5.07E-02 |

## Barytes Concrete Specific Activity (μCi/gm)

Part: #92  Weight: 3.33E+05 gms  Flux: 1.60E+11 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 1.86E-01 | 1.76E-01 | 1.41E-01 | 1.06E-01 | 6.06E-02 | 4.57E-02 | 1.12E-02 |
| C 14 | 5.10E-04 | 5.10E-04 | 5.09E-04 | 5.09E-04 | 5.08E-04 | 5.08E-04 | 5.07E-04 |
| SI 32 | 3.08E-12 | 3.08E-12 | 3.06E-12 | 3.05E-12 | 3.01E-12 | 3.00E-12 | 2.92E-12 |
| P 32 | 2.53E-06 | 3.13E-12 | 3.06E-12 | 3.05E-12 | 3.01E-12 | 3.00E-12 | 2.92E-12 |
| S 35 | 7.89E+01 | 4.44E+00 | 4.46E-05 | 2.53E-11 | 8.09E-24 | | |
| CL 36 | 8.22E-09 | 8.22E-09 | 8.22E-09 | 8.22E-09 | 8.22E-09 | 8.22E-09 | 8.22E-09 |
| AR 39 | 1.32E-14 | 1.32E-14 | 1.31E-14 | 1.29E-14 | 1.26E-14 | 1.24E-14 | 1.16E-14 |
| CA 41 | 9.20E-03 | 9.20E-03 | 9.20E-03 | 9.20E-03 | 9.20E-03 | 9.20E-03 | 9.20E-03 |
| CA 45 | 4.91E+01 | 1.04E+01 | 2.08E-02 | 8.79E-06 | 1.58E-12 | 6.66E-16 | |
| SC 46 | 1.92E-03 | 9.37E-05 | 5.29E-10 | 1.45E-16 | | | |
| FE 55 | 5.73E+01 | 4.39E+01 | 1.51E+01 | 3.98E+00 | 2.77E-01 | 7.30E-02 | 9.34E-05 |
| FE 59 | 6.94E+00 | 2.50E-02 | 4.22E-12 | 2.56E-24 | | | |
| CO 60 | 1.68E+01 | 1.47E+01 | 8.69E+00 | 4.50E+00 | 1.21E+00 | 6.26E-01 | 2.34E-02 |
| NI 63 | 1.25E-06 | 1.24E-06 | 1.20E-06 | 1.16E-06 | 1.07E-06 | 1.03E-06 | 8.56E-07 |
| ZN 65 | 7.54E+00 | 2.67E+00 | 4.20E-02 | 2.34E-04 | 7.24E-09 | 4.03E-11 | 2.16E-22 |
| CS134 | 2.80E-05 | 2.00E-05 | 5.22E-06 | 9.72E-07 | 3.37E-08 | 6.28E-09 | 1.41E-12 |
| CS135 | 3.97E-15 | 3.97E-15 | 3.97E-15 | 3.97E-15 | 3.97E-15 | 3.97E-15 | 3.97E-15 |
| CS137 | 7.52E-24 | 7.52E-24 | 7.52E-24 | 7.52E-24 | 7.52E-24 | 7.52E-24 | 7.52E-24 |
| BA133 | 4.69E+00 | 4.40E+00 | 3.40E+00 | 2.45E+00 | 1.29E+00 | 9.34E-01 | 1.86E-01 |
| BA137M | 7.32E+00 | 7.11E-24 | 7.11E-24 | 7.11E-24 | 7.11E-24 | 7.11E-24 | 7.11E-24 |
| CE142 | 2.87E-24 | 2.87E-24 | 2.87E-24 | 2.87E-24 | 2.87E-24 | 2.87E-24 | 2.87E-24 |
| SM148 | 1.27E-24 | 1.30E-24 | 1.30E-24 | 1.30E-24 | 1.30E-24 | 1.30E-24 | 1.30E-24 |
| SM149 | 4.02E-24 | 4.02E-24 | 4.02E-24 | 4.02E-24 | 4.02E-24 | 4.02E-24 | 4.02E-24 |
| SM151 | 3.09E-15 | 3.07E-15 | 2.98E-15 | 2.86E-15 | 2.65E-15 | 2.55E-15 | 2.10E-15 |
| EU152 | 4.78E-01 | 4.54E-01 | 3.70E-01 | 2.87E-01 | 1.72E-01 | 1.34E-01 | 3.74E-02 |
| EU154 | 5.48E-02 | 5.05E-02 | 3.66E-02 | 2.45E-02 | 1.09E-02 | 7.30E-03 | 9.74E-04 |
| EU155 | 3.06E-04 | 2.66E-04 | 1.52E-04 | 7.55E-05 | 1.87E-05 | 9.28E-06 | 2.82E-07 |
| GD152 | 2.52E-14 | 2.61E-14 | 2.90E-14 | 3.19E-14 | 3.60E-14 | 3.73E-14 | 4.07E-14 |
| GD153 | 7.57E-03 | 2.66E-03 | 4.05E-05 | 2.17E-07 | 6.20E-12 | 3.32E-14 | 1.46E-25 |
| OS194 | 3.38E-09 | 3.01E-09 | 1.90E-09 | 1.06E-09 | 3.35E-10 | 1.88E-10 | 1.05E-11 |
| IR192 | 7.07E+03 | 2.31E+02 | 7.88E-03 | 7.51E-03 | 7.29E-03 | 7.19E-03 | 6.69E-03 |
| IR192M | 7.72E-03 | 7.70E-03 | 7.61E-03 | 7.50E-03 | 7.29E-03 | 7.18E-03 | 6.68E-03 |
| IR194 | 1.50E+03 | 3.01E-09 | 1.90E-09 | 1.06E-09 | 3.35E-10 | 1.88E-10 | 1.05E-11 |
| PT193 | 1.46E-04 | 1.47E-04 | 1.46E-04 | 1.45E-04 | 1.43E-04 | 1.42E-04 | 1.37E-04 |
| Specific Activity Total | 1.18E+04 | 3.12E+02 | 2.78E+01 | 1.14E+01 | 3.04E+00 | 1.84E+00 | 2.82E-01 |
| Total Activity (Curies) | 3.92E+03 | 1.04E+02 | 9.26E+00 | 3.79E+00 | 1.01E+00 | 6.14E-01 | 9.40E-02 |

## Barytes Concrete Specific Activity (µCi/gm)

Part: #93    Weight: 7.60E+05 gms    Flux: 1.30E+11 $\frac{neutrons}{cm^2\text{-}seconds}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 1.51E-01 | 1.43E-01 | 1.14E-01 | 8.63E-02 | 4.92E-02 | 3.72E-02 | 9.14E-03 |
| C 14 | 4.14E-04 | 4.14E-04 | 4.14E-04 | 4.14E-04 | 4.13E-04 | 4.13E-04 | 4.12E-04 |
| SI 32 | 2.03E-12 | 2.03E-12 | 2.02E-12 | 2.01E-12 | 1.99E-12 | 1.98E-12 | 1.93E-12 |
| P 32 | 1.67E-06 | 2.07E-12 | 2.02E-12 | 2.01E-12 | 1.99E-12 | 1.98E-12 | 1.93E-12 |
| S 35 | 6.41E+01 | 3.61E+00 | 3.63E-05 | 2.05E-11 | 6.57E-24 | | |
| CL 36 | 5.43E-09 | 5.43E-09 | 5.43E-09 | 5.43E-09 | 5.43E-09 | 5.43E-09 | 5.43E-09 |
| AR 39 | 7.10E-15 | 7.08E-15 | 7.01E-15 | 6.92E-15 | 6.74E-15 | 6.65E-15 | 6.24E-15 |
| CA 41 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.47E-03 |
| CA 45 | 3.99E+01 | 8.44E+00 | 1.69E-02 | 7.15E-06 | 1.28E-12 | 5.41E-16 | |
| SC 46 | 1.27E-03 | 6.19E-05 | 3.49E-10 | 9.60E-17 | | | |
| FE 55 | 4.65E+01 | 3.56E+01 | 1.23E+01 | 3.23E+00 | 2.25E-01 | 5.93E-02 | 7.57E-05 |
| FE 59 | 5.64E+00 | 2.03E-02 | 3.43E-12 | 2.08E-24 | | | |
| CO 60 | 1.36E+01 | 1.19E+01 | 7.06E+00 | 3.66E+00 | 9.82E-01 | 5.09E-01 | 1.90E-02 |
| NI 63 | 1.01E-06 | 1.01E-06 | 9.77E-07 | 9.41E-07 | 8.72E-07 | 8.40E-07 | 6.96E-07 |
| ZN 65 | 6.13E+00 | 2.17E+00 | 3.41E-02 | 1.90E-04 | 5.89E-09 | 3.28E-11 | 1.75E-22 |
| CS134 | 1.85E-05 | 1.32E-05 | 3.45E-06 | 6.42E-07 | 2.23E-08 | 4.14E-09 | 9.28E-13 |
| CS135 | 2.13E-15 | 2.13E-15 | 2.13E-15 | 2.13E-15 | 2.13E-15 | 2.13E-15 | 2.13E-15 |
| CS137 | 2.66E-24 | 2.66E-24 | 2.66E-24 | 2.66E-24 | 2.66E-24 | 2.66E-24 | 2.66E-24 |
| BA133 | 3.81E+00 | 3.57E+00 | 2.76E+00 | 2.00E+00 | 1.05E+00 | 7.59E-01 | 1.51E-01 |
| BA137M | 5.95E+00 | 2.52E-24 | 2.52E-24 | 2.52E-24 | 2.52E-24 | 2.52E-24 | 2.52E-24 |
| CE142 | 1.25E-24 | 1.25E-24 | 1.25E-24 | 1.25E-24 | 1.25E-24 | 1.25E-24 | 1.25E-24 |
| SM148 | 1.04E-24 | 1.06E-24 | 1.06E-24 | 1.06E-24 | 1.06E-24 | 1.06E-24 | 1.06E-24 |
| SM149 | 2.69E-24 | 2.69E-24 | 2.69E-24 | 2.69E-24 | 2.69E-24 | 2.69E-24 | 2.69E-24 |
| SM151 | 1.36E-15 | 1.35E-15 | 1.31E-15 | 1.26E-15 | 1.17E-15 | 1.12E-15 | 9.27E-16 |
| EU152 | 3.90E-01 | 3.70E-01 | 3.02E-01 | 2.34E-01 | 1.41E-01 | 1.09E-01 | 3.05E-02 |
| EU154 | 4.45E-02 | 4.11E-02 | 2.98E-02 | 1.99E-02 | 8.89E-03 | 5.94E-03 | 7.92E-04 |
| EU155 | 2.02E-04 | 1.76E-04 | 1.01E-04 | 5.00E-05 | 1.24E-05 | 6.14E-06 | 1.86E-07 |
| GD152 | 2.06E-14 | 2.13E-14 | 2.37E-14 | 2.61E-14 | 2.94E-14 | 3.05E-14 | 3.32E-14 |
| GD153 | 5.01E-03 | 1.76E-03 | 2.68E-05 | 1.43E-07 | 4.11E-12 | 2.20E-14 | 9.63E-26 |
| OS194 | 1.81E-09 | 1.61E-09 | 1.02E-09 | 5.71E-10 | 1.80E-10 | 1.01E-10 | 5.62E-12 |
| IR192 | 5.75E+03 | 1.88E+02 | 6.40E-03 | 6.10E-03 | 5.93E-03 | 5.84E-03 | 5.44E-03 |
| IR192M | 6.27E-03 | 6.26E-03 | 6.18E-03 | 6.09E-03 | 5.92E-03 | 5.84E-03 | 5.43E-03 |
| IR194 | 1.22E+03 | 1.62E-09 | 1.02E-09 | 5.71E-10 | 1.80E-10 | 1.01E-10 | 5.62E-12 |
| PT193 | 9.62E-05 | 9.68E-05 | 9.62E-05 | 9.56E-05 | 9.43E-05 | 9.36E-05 | 9.04E-05 |
| Specific Activity Total | 9.56E+03 | 2.54E+02 | 2.26E+01 | 9.25E+00 | 2.47E+00 | 1.50E+00 | 2.30E-01 |
| Total Activity (Curies) | 7.26E+03 | 1.93E+02 | 1.72E+01 | 7.03E+00 | 1.88E+00 | 1.14E+00 | 1.74E-01 |

| Barytes Concrete Specific Activity (μCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #94 | Weight: 9.75E+Ø5 gms | | | Flux: 2.6ØE+Ø9 $\frac{neutrons}{cm^2 - seconds}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | Ø | 1 | 5 | 1Ø | 2Ø | 25 | 5Ø |
| H 3 | 3.Ø3E-Ø3 | 2.86E-Ø3 | 2.29E-Ø3 | 1.73E-Ø3 | 9.86E-Ø4 | 7.45E-Ø4 | 1.83E-Ø4 |
| C 14 | 8.28E-Ø6 | 8.28E-Ø6 | 8.28E-Ø6 | 8.27E-Ø6 | 8.26E-Ø6 | 8.26E-Ø6 | 8.23E-Ø6 |
| SI 32 | 8.13E-16 | 8.12E-16 | 8.Ø9E-16 | 8.Ø4E-16 | 7.96E-16 | 7.92E-16 | 7.71E-16 |
| P 32 | 6.68E-1Ø | 8.26E-16 | 8.Ø9E-16 | 8.Ø5E-16 | 7.96E-16 | 7.92E-16 | 7.71E-16 |
| S 35 | 1.28E+ØØ | 7.22E-Ø2 | 7.25E-Ø7 | 4.1ØE-13 | 1.31E-25 | | |
| CL 36 | 2.17E-12 | 2.17E-12 | 2.17E-12 | 2.17E-12 | 2.17E-12 | 2.17E-12 | 2.17E-12 |
| AR 39 | 5.65E-2Ø | 5.64E-2Ø | 5.58E-2Ø | 5.51E-2Ø | 5.37E-2Ø | 5.3ØE-2Ø | 4.96E-2Ø |
| CA 41 | 1.5ØE-Ø4 | 1.5ØE-Ø4 | 1.5ØE-Ø4 | 1.5ØE-Ø4 | 1.5ØE-Ø4 | 1.5ØE-Ø4 | 1.5ØE-Ø4 |
| CA 45 | 7.98E-Ø1 | 1.69E-Ø1 | 3.37E-Ø4 | 1.43E-Ø7 | 2.55E-14 | 1.Ø8E-17 | |
| SC 46 | 5.Ø8E-Ø7 | 2.47E-Ø8 | 1.4ØE-13 | 3.84E-2Ø | | | |
| FE 55 | 9.3ØE-Ø1 | 7.13E-Ø1 | 2.45E-Ø1 | 6.47E-Ø2 | 4.5ØE-Ø3 | 1.19E-Ø3 | 1.51E-Ø6 |
| CO 6Ø | 2.73E-Ø1 | 2.39E-Ø1 | 1.41E-Ø1 | 7.32E-Ø2 | 1.96E-Ø2 | 1.Ø2E-Ø2 | 3.8ØE-Ø4 |
| NI 63 | 2.Ø3E-Ø8 | 2.Ø1E-Ø8 | 1.95E-Ø8 | 1.88E-Ø8 | 1.74E-Ø8 | 1.68E-Ø8 | 1.39E-Ø8 |
| ZN 65 | 1.22E-Ø1 | 4.34E-Ø2 | 6.82E-Ø4 | 3.8ØE-Ø6 | 1.18E-1Ø | 6.56E-13 | 3.51E-24 |
| CS134 | 7.44E-Ø9 | 5.32E-Ø9 | 1.39E-Ø9 | 2.58E-1Ø | 8.95E-12 | 1.67E-12 | 3.73E-16 |
| CS135 | 1.71E-2Ø | 1.71E-2Ø | 1.71E-2Ø | 1.71E-2Ø | 1.71E-2Ø | 1.71E-2Ø | 1.71E-2Ø |
| BA133 | 7.64E-Ø2 | 7.17E-Ø2 | 5.54E-Ø2 | 4.Ø1E-Ø2 | 2.1ØE-Ø2 | 1.52E-Ø2 | 3.Ø3E-Ø3 |
| EU152 | 7.96E-Ø3 | 7.56E-Ø3 | 6.17E-Ø3 | 4.78E-Ø3 | 2.87E-Ø3 | 2.23E-Ø3 | 6.23E-Ø4 |
| EU154 | 8.94E-Ø4 | 8.25E-Ø4 | 5.97E-Ø4 | 3.99E-Ø4 | 1.78E-Ø4 | 1.19E-Ø4 | 1.59E-Ø5 |
| EU155 | 8.14E-Ø8 | 7.Ø8E-Ø8 | 4.Ø5E-Ø8 | 2.Ø1E-Ø8 | 4.97E-Ø9 | 2.47E-Ø9 | 7.51E-11 |
| GD152 | 4.19E-16 | 4.33E-16 | 4.82E-16 | 5.31E-16 | 5.98E-16 | 6.21E-16 | 6.77E-16 |
| GD153 | 2.Ø3E-Ø6 | 7.13E-Ø7 | 1.Ø9E-Ø8 | 5.81E-11 | 1.66E-15 | 8.93E-18 | |
| OS194 | 1.47E-14 | 1.31E-14 | 8.23E-15 | 4.62E-15 | 1.45E-15 | 8.16E-16 | 4.55E-17 |
| IR192 | 1.15E[illegible] | 3.77E+ØØ | 1.28E-Ø4 | 1.22E-Ø4 | 1.19E-Ø4 | 1.17E-Ø4 | 1.Ø9E-Ø4 |
| IR192M | 1.26E-Ø4 | 1.25E-Ø4 | 1.24E-Ø4 | 1.22E-Ø4 | 1.19E-Ø4 | 1.17E-Ø4 | 1.Ø9E-Ø4 |
| IR194 | 2.43E+Ø1 | 1.31E-14 | 8.23E-15 | 4.62E-15 | 1.45E-15 | 8.17E-16 | 4.55E-17 |
| PT193 | 3.87E-Ø8 | 3.9ØE-Ø8 | 3.87E-Ø8 | 3.85E-Ø8 | 3.79E-Ø8 | 3.77E-Ø8 | 3.64E-Ø8 |
| Specific Activity Total | 1.92E+Ø2 | 5.Ø9E+ØØ | 4.53E-Ø1 | 1.85E-Ø1 | 4.96E-Ø2 | 3.Ø1E-Ø2 | 4.61E-Ø3 |
| Total Activity (Curies) | 1.87E+Ø2 | 4.96E+ØØ | 4.41E-Ø1 | 1.81E-Ø1 | 4.84E-Ø2 | 2.93E-Ø2 | 4.5ØE-Ø3 |

Barytes Concrete Specific Activity (µCi/gm)

Part: #95 Weight: 9.92E+05 gms Flux: 3.30E+09 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 3.85E-03 | 3.64E-03 | 2.91E-03 | 2.19E-03 | 1.25E-03 | 9.45E-04 | 2.32E-04 |
| C 14 | 1.05E-05 | 1.05E-05 | 1.05E-05 | 1.05E-05 | 1.05E-05 | 1.05E-05 | 1.04E-05 |
| SI 32 | 1.31E-15 | 1.31E-15 | 1.30E-15 | 1.30E-15 | 1.28E-15 | 1.28E-15 | 1.24E-15 |
| P 32 | 1.08E-09 | 1.33E-15 | 1.30E-15 | 1.30E-15 | 1.28E-15 | 1.28E-15 | 1.24E-15 |
| S 35 | 1.63E+00 | 9.16E-02 | 9.21E-07 | 5.21E-13 | 1.67E-25 | | |
| CL 36 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 |
| AR 39 | 1.15E-19 | 1.15E-19 | 1.14E-19 | 1.13E-19 | 1.10E-19 | 1.08E-19 | 1.01E-19 |
| CA 41 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 |
| CA 45 | 1.01E+00 | 2.14E-01 | 4.29E-04 | 1.81E-07 | 3.25E-14 | 1.38E-17 | |
| SC 46 | 8.18E-07 | 3.99E-08 | 2.25E-13 | 6.19E-20 | | | |
| FE 55 | 1.18E+00 | 9.04E-01 | 3.11E-01 | 8.21E-02 | 5.71E-03 | 1.51E-03 | 1.91E-06 |
| FE 59 | 1.43E-01 | 5.16E-04 | 8.69E-14 | 5.28E-26 | | | |
| CO 60 | 3.46E-01 | 3.03E-01 | 1.79E-01 | 9.29E-02 | 2.49E-02 | 1.29E-02 | 4.82E-04 |
| NI 63 | 2.57E-08 | 2.56E-08 | 2.48E-08 | 2.39E-08 | 2.21E-08 | 2.13E-08 | 1.77E-08 |
| ZN 65 | 1.55E-01 | 5.51E-02 | 8.65E-04 | 4.82E-06 | 1.49E-10 | 8.31E-13 | 4.45E-24 |
| CS134 | 1.20E-08 | 8.56E-09 | 2.23E-09 | 4.16E-10 | 1.44E-11 | 2.68E-12 | 6.01E-16 |
| CS135 | 3.50E-20 | 3.50E-20 | 3.50E-20 | 3.50E-20 | 3.50E-20 | 3.50E-20 | 3.50E-20 |
| BA133 | 9.70E-02 | 9.10E-02 | 7.03E-02 | 5.09E-02 | 2.67E-02 | 1.93E-02 | 3.85E-03 |
| EU152 | 1.01E-02 | 9.60E-03 | 7.83E-03 | 6.07E-03 | 3.64E-03 | 2.82E-03 | 7.90E-04 |
| EU154 | 1.13E-03 | 1.05E-03 | 7.58E-04 | 5.07E-04 | 2.26E-04 | 1.51E-04 | 2.02E-05 |
| EU155 | 1.31E-07 | 1.14E-07 | 6.52E-08 | 3.24E-08 | 8.01E-09 | 3.98E-09 | 1.21E-10 |
| GD152 | 5.32E-16 | 5.50E-16 | 6.12E-16 | 6.74E-16 | 7.59E-16 | 7.88E-16 | 8.59E-16 |
| GD153 | 3.27E-06 | 1.15E-06 | 1.75E-08 | 9.37E-11 | 2.68E-15 | 1.43E-17 | |
| OS194 | 3.00E-14 | 2.67E-14 | 1.68E-14 | 9.44E-15 | 2.98E-15 | 1.67E-15 | 9.30E-17 |
| IR192 | 1.46E+02 | 4.79E+00 | 1.63E-04 | 1.55E-04 | 1.51E-04 | 1.49E-04 | 1.38E-04 |
| IR192M | 1.60E-04 | 1.59E-04 | 1.57E-04 | 1.55E-04 | 1.51E-04 | 1.48E-04 | 1.38E-04 |
| IR194 | 3.08E+01 | 2.67E-14 | 1.68E-14 | 9.45E-15 | 2.98E-15 | 1.67E-15 | 9.30E-17 |
| PT193 | 6.24E-08 | 6.28E-08 | 6.24E-08 | 6.20E-08 | 6.11E-08 | 6.07E-08 | 5.86E-08 |
| Specific Activity Total | 2.43E+02 | 6.46E+00 | 5.74E-01 | 2.35E-01 | 6.30E-02 | 3.82E-02 | 5.85E-03 |
| Total Activity (Curies) | 2.41E+02 | 6.41E+00 | 5.70E-01 | 2.33E-01 | 6.24E-02 | 3.79E-02 | 5.81E-03 |

## Barytes Concrete Specific Activity (µCi/gm)

Part: #96 Weight: 3.00E+05 gms Flux: 2.40E+10 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$

| Nuclide | Years after shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|
| H 3 | 2.80E-02 | 2.64E-02 | 2.11E-02 | 1.59E-02 | 9.10E-03 | 6.87E-03 | 1.69E-03 |
| C 14 | 7.65E-05 | 7.65E-05 | 7.64E-05 | 7.64E-05 | 7.63E-05 | 7.62E-05 | 7.60E-05 |
| SI 32 | 6.93E-14 | 6.92E-14 | 6.89E-14 | 6.85E-14 | 6.78E-14 | 6.75E-14 | 6.57E-14 |
| P 32 | 5.69E-08 | 7.04E-14 | 6.89E-14 | 6.86E-14 | 6.78E-14 | 6.75E-14 | 6.57E-14 |
| S 35 | 1.18E+01 | 6.66E-01 | 6.69E-06 | 3.79E-12 | 1.21E-24 | | |
| CL 36 | 1.85E-10 | 1.85E-10 | 1.85E-10 | 1.85E-10 | 1.85E-10 | 1.85E-10 | 1.85E-10 |
| AR 39 | 4.47E-17 | 4.46E-17 | 4.41E-17 | 4.35E-17 | 4.24E-17 | 4.19E-17 | 3.93E-17 |
| CA 41 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 |
| CA 45 | 7.37E+00 | 1.56E+00 | 3.11E-03 | 1.32E-06 | 2.36E-13 | 9.98E-17 | |
| SC 46 | 4.33E-05 | 2.11E-06 | 1.19E-11 | 3.27E-18 | | | |
| FE 55 | 8.59E+00 | 6.58E+00 | 2.27E+00 | 5.97E-01 | 4.15E-02 | 1.09E-02 | 1.40E-05 |
| FE 59 | 1.04E+00 | 3.75E-03 | 6.32E-13 | 3.84E-25 | | | |
| CO 60 | 2.52E+00 | 2.21E+00 | 1.30E+00 | 6.75E-01 | 1.81E-01 | 9.39E-02 | 3.50E-03 |
| NI 63 | 1.87E-07 | 1.86E-07 | 1.80E-07 | 1.74E-07 | 1.61E-07 | 1.55E-07 | 1.28E-07 |
| ZN 65 | 1.13E+00 | 4.00E-01 | 6.30E-03 | 3.50E-05 | 1.09E-09 | 6.05E-12 | 3.24E-23 |
| CS134 | 6.34E-07 | 4.53E-07 | 1.18E-07 | 2.20E-08 | 7.62E-10 | 1.42E-10 | 3.18E-14 |
| CS135 | 1.35E-17 | 1.35E-17 | 1.35E-17 | 1.35E-17 | 1.35E-17 | 1.35E-17 | 1.35E-17 |
| BA133 | 7.05E-01 | 6.61E-01 | 5.11E-01 | 3.70E-01 | 1.94E-01 | 1.41E-01 | 2.80E-02 |
| SM148 | 1.94E-25 | 1.99E-25 | 1.99E-25 | 1.99E-25 | 1.99E-25 | 1.99E-25 | 1.99E-25 |
| SM149 | 9.63E-26 | 9.63E-26 | 9.63E-26 | 9.63E-26 | 9.63E-26 | 9.63E-26 | 9.63E-26 |
| SM151 | 1.64E-18 | 1.63E-18 | 1.58E-18 | 1.52E-18 | 1.41E-18 | 1.36E-18 | 1.12E-18 |
| EU152 | 7.32E-02 | 6.96E-02 | 5.68E-02 | 4.40E-02 | 2.64E-02 | 2.05E-02 | 5.73E-03 |
| EU154 | 8.25E-03 | 7.61E-03 | 5.51E-03 | 3.68E-03 | 1.64E-03 | 1.10E-03 | 1.47E-04 |
| EU155 | 6.93E-06 | 6.02E-06 | 3.45E-06 | 1.71E-06 | 4.23E-07 | 2.10E-07 | 6.39E-09 |
| GD152 | 3.85E-15 | 3.99E-15 | 4.44E-15 | 4.89E-15 | 5.50E-15 | 5.71E-15 | 6.23E-15 |
| GD153 | 1.73E-04 | 6.06E-05 | 9.24E-07 | 4.94E-09 | 1.42E-13 | 7.56E-16 | |
| OS194 | 1.15E-11 | 1.03E-11 | 6.47E-12 | 3.63E-12 | 1.14E-12 | 6.42E-13 | 3.57E-14 |
| IR192 | 1.06E+03 | 3.48E+01 | 1.18E-03 | 1.13E-03 | 1.10E-03 | 1.08E-03 | 1.01E-03 |
| IR192M | 1.16E-03 | 1.16E-03 | 1.14E-03 | 1.13E-03 | 1.10E-03 | 1.08E-03 | 1.00E-03 |
| IR194 | 2.24E+02 | 1.03E-11 | 6.47E-12 | 3.63E-12 | 1.14E-12 | 6.42E-13 | 3.58E-14 |
| PT193 | 3.28E-06 | 3.30E-06 | 3.28E-06 | 3.26E-06 | 3.22E-06 | 3.19E-06 | 3.09E-06 |
| Specific Activity Total | 1.77E+03 | 4.70E+01 | 4.18E+00 | 1.71E+00 | 4.58E-01 | 2.77E-01 | 4.25E-02 |
| Total Activity (Curies) | 5.30E+02 | 1.41E+01 | 1.25E+00 | 5.13E-01 | 1.37E-01 | 8.32E-02 | 1.28E-02 |

## Barytes Concrete Specific Activity (μCi/gm)

Part: #97 Weight: 7.09E+05 gms Flux: 1.60E+07 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.86E-05 | 1.76E-05 | 1.41E-05 | 1.06E-05 | 6.07E-06 | 4.58E-06 | 1.13E-06 |
| C 14 | 5.10E-08 | 5.10E-08 | 5.09E-08 | 5.09E-08 | 5.09E-08 | 5.08E-08 | 5.07E-08 |
| SI 32 | 3.08E-20 | 3.08E-20 | 3.07E-20 | 3.05E-20 | 3.02E-20 | 3.00E-20 | 2.92E-20 |
| P 32 | 2.53E-14 | 3.13E-20 | 3.07E-20 | 3.05E-20 | 3.02E-20 | 3.00E-20 | 2.92E-20 |
| S 35 | 7.89E-03 | 4.44E-04 | 4.46E-09 | 2.53E-15 | | | |
| CL 36 | 8.22E-17 | 8.22E-17 | 8.22E-17 | 8.22E-17 | 8.22E-17 | 8.22E-17 | 8.22E-17 |
| CA 41 | 9.20E-07 | 9.20E-07 | 9.20E-07 | 9.20E-07 | 9.20E-07 | 9.20E-07 | 9.20E-07 |
| CA 45 | 4.91E-03 | 1.04E-03 | 2.08E-06 | 8.80E-10 | 1.58E-16 | 6.67E-20 | |
| SC 46 | 1.92E-11 | 9.37E-13 | 5.29E-18 | 1.45E-24 | | | |
| FE 55 | 5.73E-03 | 4.39E-03 | 1.51E-03 | 3.98E-04 | 2.77E-05 | 7.30E-06 | 9.32E-09 |
| CO 60 | 1.68E-03 | 1.47E-03 | 8.69E-04 | 4.50E-04 | 1.21E-04 | 6.26E-05 | 2.34E-06 |
| NI 63 | 1.25E-10 | 1.24E-10 | 1.20E-10 | 1.16E-10 | 1.07E-10 | 1.03E-10 | 8.56E-11 |
| ZN 65 | 7.54E-04 | 2.67E-04 | 4.20E-06 | 2.34E-08 | 7.25E-13 | 4.03E-15 | |
| CS134 | 2.82E-13 | 2.01E-13 | 5.25E-14 | 9.77E-15 | 3.39E-16 | 6.31E-17 | 1.41E-20 |
| BA133 | 4.70E-04 | 4.41E-04 | 3.41E-04 | 2.47E-04 | 1.29E-04 | 9.37E-05 | 1.87E-05 |
| EU152 | 4.90E-05 | 4.66E-05 | 3.80E-05 | 2.94E-05 | 1.77E-05 | 1.37E-05 | 3.83E-06 |
| EU154 | 5.50E-06 | 5.07E-06 | 3.68E-06 | 2.46E-06 | 1.10E-06 | 7.33E-07 | 9.78E-08 |
| EU155 | 3.08E-12 | 2.68E-12 | 1.53E-12 | 7.62E-13 | 1.88E-13 | 9.36E-14 | 2.84E-15 |
| GD152 | 2.60E-18 | 2.69E-18 | 2.99E-18 | 3.29E-18 | 3.70E-18 | 3.84E-18 | 4.19E-18 |
| GD153 | 7.79E-11 | 2.74E-11 | 4.17E-13 | 2.23E-15 | 6.38E-20 | 1.66E-20 | |
| OS194 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 |
| IR192 | 7.10E-01 | 2.32E-02 | 7.90E-07 | 7.52E-07 | 7.31E-07 | 7.20E-07 | 6.70E-07 |
| IR192M | 7.73E-07 | 7.71E-07 | 7.62E-07 | 7.52E-07 | 7.30E-07 | 7.20E-07 | 6.70E-07 |
| IR194 | 1.49E-01 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 | 3.80E-23 |
| PT193 | 1.47E-12 | 1.48E-12 | 1.47E-12 | 1.46E-12 | 1.44E-12 | 1.43E-12 | 1.38E-12 |
| Specific Activity Total | 1.18E+00 | 3.13E-02 | 2.78E-03 | 1.14E-03 | 3.05E-04 | 1.85E-04 | 2.84E-05 |
| Total Activity (Curies) | 8.36E-01 | 2.22E-02 | 1.97E-03 | 8.08E-04 | 2.16E-04 | 1.31E-04 | 2.01E-05 |

Barytes Concrete Specific Activity (µCi/gm)

Part: #98 Weight: 4.15E+06 gms Flux: 1.30E+09 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$

| | Years after shutdown | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 1.52E-03 | 1.43E-03 | 1.14E-03 | 8.64E-04 | 4.93E-04 | 3.72E-04 | 9.15E-05 |
| C 14 | 4.14E-06 | 4.14E-06 | 4.14E-06 | 4.14E-06 | 4.13E-06 | 4.13E-06 | 4.12E-06 |
| SI 32 | 2.03E-16 | 2.03E-16 | 2.02E-16 | 2.01E-16 | 1.99E-16 | 1.98E-16 | 1.93E-16 |
| P 32 | 1.67E-10 | 2.07E-16 | 2.02E-16 | 2.01E-16 | 1.99E-16 | 1.98E-16 | 1.93E-16 |
| S 35 | 6.41E-01 | 3.61E-02 | 3.63E-07 | 2.05E-13 | 6.57E-26 | | |
| CL 36 | 5.43E-13 | 5.43E-13 | 5.43E-13 | 5.43E-13 | 5.43E-13 | 5.43E-13 | 5.43E-13 |
| AR 39 | 6.76E-21 | 6.76E-21 | 6.76E-21 | 6.76E-21 | 6.58E-21 | 6.58E-21 | 6.16E-21 |
| CA 41 | 7.48E-05 | 7.48E-05 | 7.48E-05 | 7.48E-05 | 7.48E-05 | 7.48E-05 | 7.48E-05 |
| CA 45 | 3.99E-01 | 8.44E-02 | 1.68E-04 | 7.13E-08 | 1.28E-14 | 5.40E-18 | |
| SC 46 | 1.27E-07 | 6.19E-09 | 3.49E-14 | 9.60E-21 | | | |
| FE 55 | 4.65E-01 | 3.56E-01 | 1.23E-01 | 3.23E-02 | 2.25E-03 | 5.93E-04 | 7.52E-07 |
| CO 60 | 1.36E-01 | 1.19E-01 | 7.06E-02 | 3.66E-02 | 9.82E-03 | 5.09E-03 | 1.90E-04 |
| NI 63 | 1.01E-08 | 1.01E-08 | 9.77E-09 | 9.41E-09 | 8.72E-09 | 8.40E-09 | 6.96E-09 |
| ZN 65 | 6.12E-02 | 2.17E-02 | 3.41E-04 | 1.90E-06 | 5.89E-11 | 3.28E-13 | 1.75E-24 |
| CS134 | 1.86E-09 | 1.33E-09 | 3.46E-10 | 6.45E-11 | 2.24E-12 | 4.17E-13 | 9.33E-17 |
| CS135 | 2.14E-21 | 2.14E-21 | 2.14E-21 | 2.14E-21 | 2.14E-21 | 2.14E-21 | 2.14E-21 |
| BA133 | 3.82E-02 | 3.58E-02 | 2.77E-02 | 2.00E-02 | 1.05E-02 | 7.62E-03 | 1.52E-03 |
| EU152 | 3.98E-03 | 3.78E-03 | 3.09E-03 | 2.39E-03 | 1.44E-03 | 1.11E-03 | 3.11E-04 |
| EU154 | 4.47E-04 | 4.12E-04 | 2.99E-04 | 2.00E-04 | 8.91E-05 | 5.96E-05 | 7.94E-06 |
| EU155 | 2.04E-08 | 1.77E-08 | 1.01E-08 | 5.03E-09 | 1.24E-09 | 6.18E-10 | 1.88E-11 |
| GD152 | 2.10E-16 | 2.17E-16 | 2.41E-16 | 2.66E-16 | 2.99E-16 | 3.10E-16 | 3.39E-16 |
| GD153 | 5.08E-07 | 1.78E-07 | 2.72E-09 | 1.45E-11 | 4.16E-16 | 2.19E-18 | |
| OS194 | 1.83E-15 | 1.63E-15 | 1.03E-15 | 5.77E-16 | 1.82E-16 | 1.02E-16 | 5.68E-18 |
| IR192 | 5.77E+01 | 1.89E+00 | 6.42E-05 | 6.11E-05 | 5.94E-05 | 5.85E-05 | 5.45E-05 |
| IR192M | 6.28E-05 | 6.27E-05 | 6.19E-05 | 6.11E-05 | 5.93E-05 | 5.85E-05 | 5.44E-05 |
| IR194 | 1.22E+01 | 1.63E-15 | 1.03E-15 | 5.78E-16 | 1.82E-16 | 1.02E-16 | 5.69E-18 |
| PT193 | 9.68E-09 | 9.74E-09 | 9.69E-09 | 9.62E-09 | 9.49E-09 | 9.42E-09 | 9.10E-09 |
| Specific Activity Total | 9.58E+01 | 2.55E+00 | 2.26E-01 | 9.26E-02 | 2.48E-02 | 1.50E-02 | 2.31E-03 |
| Total Activity (Curies) | 3.98E+02 | 1.06E+01 | 9.39E-01 | 3.84E-01 | 1.03E-01 | 6.24E-02 | 9.57E-03 |

| Barytes Concrete Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #99 | Weight: 3.00E+06 gms | | | Flux: 4.80E+08 $\frac{neutrons}{cm^2 - seconds}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 5.59E-04 | 5.29E-04 | 4.23E-04 | 3.19E-04 | 1.82E-04 | 1.38E-04 | 3.38E-05 |
| C 14 | 1.53E-06 | 1.53E-06 | 1.53E-06 | 1.53E-06 | 1.53E-06 | 1.53E-06 | 1.52E-06 |
| SI 32 | 2.77E-17 | 2.77E-17 | 2.76E-17 | 2.74E-17 | 2.71E-17 | 2.70E-17 | 2.63E-17 |
| P 32 | 2.28E-11 | 2.81E-17 | 2.76E-17 | 2.74E-17 | 2.71E-17 | 2.70E-17 | 2.63E-17 |
| S 35 | 2.37E-01 | 1.33E-02 | 1.34E-07 | 7.58E-14 | | | |
| CL 36 | 7.40E-14 | 7.40E-14 | 7.40E-14 | 7.40E-14 | 7.40E-14 | 7.40E-14 | 7.40E-14 |
| AR 39 | 1.48E-22 | 1.48E-22 | 1.48E-22 | 1.48E-22 | 1.48E-22 | 1.48E-22 | 1.48E-22 |
| CA 41 | 2.76E-05 | 2.76E-05 | 2.76E-05 | 2.76E-05 | 2.76E-05 | 2.76E-05 | 2.76E-05 |
| CA 45 | 1.47E-01 | 3.12E-02 | 6.24E-05 | 2.64E-08 | 4.73E-15 | 2.00E-18 | |
| SC 46 | 1.73E-08 | 8.43E-10 | 4.76E-15 | 1.31E-21 | | | |
| FE 55 | 1.72E-01 | 1.32E-01 | 4.53E-02 | 1.19E-02 | 8.30E-04 | 2.19E-04 | 2.79E-07 |
| CO 60 | 5.03E-02 | 4.41E-02 | 2.61E-02 | 1.35E-02 | 3.63E-03 | 1.88E-03 | 7.01E-05 |
| NI 63 | 3.74E-09 | 3.72E-09 | 3.61E-09 | 3.47E-09 | 3.22E-09 | 3.10E-09 | 2.57E-09 |
| ZN 65 | 2.26E-02 | 8.01E-03 | 1.26E-04 | 7.01E-07 | 2.17E-11 | 1.21E-13 | 6.47E-25 |
| CS134 | 2.54E-10 | 1.81E-10 | 4.72E-11 | 8.79E-12 | 3.05E-13 | 5.68E-14 | 1.27E-17 |
| CS135 | 1.08E-22 | 1.08E-22 | 1.08E-22 | 1.08E-22 | 1.08E-22 | 1.08E-22 | 1.08E-22 |
| BA133 | 1.41E-02 | 1.32E-02 | 1.02E-02 | 7.40E-03 | 3.88E-03 | 2.81E-03 | 5.60E-04 |
| EU152 | 1.47E-03 | 1.40E-03 | 1.14E-03 | 8.83E-04 | 5.30E-04 | 4.11E-04 | 1.15E-04 |
| EU154 | 1.65E-04 | 1.52E-04 | 1.10E-04 | 7.37E-05 | 3.29E-05 | 2.20E-05 | 2.93E-06 |
| EU155 | 2.78E-09 | 2.41E-09 | 1.38E-09 | 6.86E-10 | 1.70E-10 | 8.43E-11 | 2.56E-12 |
| GD152 | 7.74E-17 | 8.01E-17 | 8.91E-17 | 9.81E-17 | 1.10E-16 | 1.15E-16 | 1.25E-16 |
| GD153 | 6.92E-08 | 2.43E-08 | 3.70E-10 | 1.98E-12 | 5.67E-17 | 3.20E-19 | |
| OS194 | 9.23E-17 | 8.22E-17 | 5.18E-17 | 2.91E-17 | 9.15E-18 | 5.14E-18 | 2.83E-19 |
| IR192 | 2.13E+01 | 6.96E-01 | 2.37E-05 | 2.26E-05 | 2.19E-05 | 2.16E-05 | 2.01E-05 |
| IR192M | 2.32E-05 | 2.31E-05 | 2.29E-05 | 2.25E-05 | 2.19E-05 | 2.16E-05 | 2.01E-05 |
| IR194 | 4.49E+00 | 8.23E-17 | 5.18E-17 | 2.91E-17 | 9.16E-18 | 5.14E-18 | 2.86E-19 |
| PT193 | 1.32E-09 | 1.33E-09 | 1.32E-09 | 1.31E-09 | 1.29E-09 | 1.29E-09 | 1.24E-09 |
| Specific Activity Total | 3.54E+01 | 9.40E-01 | 8.35E-02 | 3.42E-02 | 9.16E-03 | 5.55E-03 | 8.51E-04 |
| Total Activity (Curies) | 1.06E+02 | 2.82E+00 | 2.51E-01 | 1.03E-01 | 2.75E-02 | 1.67E-02 | 2.55E-03 |

| Barytes Concrete Specific Activity (µCi/gm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Part: #100 | Weight: 3.04E+06 gms | | | Flux: 4.20E+08 $\frac{\text{neutrons}}{\text{cm}^2\text{-seconds}}$ | | | |
| | Years after shutdown | | | | | | |
| Nuclide | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| H 3 | 4.90E-04 | 4.63E-04 | 3.70E-04 | 1.99E-04 | 1.89E-04 | 1.59E-04 | 1.20E-04 |
| C 14 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.33E-06 | 1.33E-06 | 1.33E-06 | 1.33E-06 |
| SI 32 | 2.12E-17 | 2.12E-17 | 2.11E-17 | 2.09E-17 | 2.08E-17 | 2.08E-17 | 2.07E-17 |
| P 32 | 1.63E-11 | 2.15E-17 | 2.11E-17 | 2.09E-17 | 2.08E-17 | 2.08E-17 | 2.07E-17 |
| S 35 | 2.07E-01 | 1.17E-02 | 1.17E-07 | 2.11E-21 | 2.11E-21 | 3.77E-25 | |
| CL 36 | 5.66E-14 | 5.66E-14 | 5.66E-14 | 5.66E-14 | 5.66E-14 | 5.66E-14 | 5.66E-14 |
| CA 41 | 2.42E-05 | 2.42E-05 | 2.42E-05 | 2.42E-05 | 2.42E-05 | 2.42E-05 | 2.42E-05 |
| CA 45 | 1.29E-01 | 2.73E-02 | 5.46E-05 | 2.07E-12 | 4.37E-13 | 4.14E-15 | 1.75E-18 |
| FE 55 | 1.50E-01 | 1.15E-01 | 3.96E-02 | 2.11E-03 | 1.62E-03 | 7.27E-04 | 1.92E-04 |
| CO 60 | 4.40E-02 | 3.86E-02 | 2.28E-02 | 5.37E-03 | 4.71E-03 | 3.17E-03 | 1.64E-03 |
| NI 63 | 3.28E-09 | 3.25E-09 | 3.15E-09 | 2.90E-09 | 2.88E-09 | 2.82E-09 | 2.71E-09 |
| ZN 65 | 1.98E-02 | 7.01E-03 | 1.10E-04 | 1.21E-09 | 4.28E-10 | 1.90E-11 | 1.06E-13 |
| CS134 | 1.94E-10 | 1.39E-10 | 3.62E-11 | 8.96E-13 | 6.40E-13 | 2.34E-13 | 4.35E-14 |
| CS135 | 7.22E-23 | 7.22E-23 | 7.22E-23 | 7.22E-23 | 7.22E-23 | 7.22E-23 | 7.22E-23 |
| BA133 | 1.23E-02 | 1.16E-02 | 8.95E-03 | 4.40E-03 | 4.13E-03 | 3.40E-03 | 2.46E-03 |
| EU152 | 1.29E-03 | 1.22E-03 | 9.97E-04 | 5.69E-04 | 5.41E-04 | 4.64E-04 | 3.60E-04 |
| EU154 | 1.44E-04 | 1.33E-04 | 9.65E-05 | 3.98E-05 | 3.67E-05 | 2.88E-05 | 1.93E-05 |
| EU155 | 2.13E-09 | 1.85E-09 | 1.06E-09 | 2.27E-10 | 1.97E-10 | 1.30E-10 | 6.45E-11 |
| GD152 | 6.77E-17 | 7.00E-17 | 7.80E-17 | 9.30E-17 | 9.40E-17 | 9.66E-17 | 1.00E-16 |
| GD153 | 5.30E-08 | 1.86E-08 | 2.84E-10 | 2.85E-15 | 1.00E-15 | 4.35E-17 | 2.45E-19 |
| OS194 | 6.22E-17 | 5.54E-17 | 3.49E-17 | 9.79E-18 | 8.72E-18 | 6.16E-18 | 3.46E-18 |
| IR192 | 1.86E+01 | 6.09E-01 | 2.07E-05 | 1.94E-05 | 1.93E-05 | 1.92E-05 | 1.89E-05 |
| IR192M | 2.03E-05 | 2.02E-05 | 2.00E-05 | 1.94E-05 | 1.93E-05 | 1.92E-05 | 1.89E-05 |
| IR194 | 3.92E+00 | 5.54E-17 | 3.49E-17 | 9.80E-18 | 8.73E-18 | 6.17E-18 | 3.46E-18 |
| PT193 | 1.01E-09 | 1.02E-09 | 1.01E-09 | 9.96E-10 | 9.95E-10 | 9.90E-10 | 9.83E-10 |
| Specific Activity Total | 3.09E+01 | 8.23E-01 | 7.31E-02 | 1.27E-02 | 1.13E-02 | 8.01E-03 | 4.86E-03 |
| Total Activity (Curies) | 9.41E+01 | 2.50E+00 | 2.22E-01 | 3.88E-02 | 3.43E-02 | 2.44E-02 | 1.48E-02 |

## Appendix D: Material Activities

Tables D-1 through D-6 list the material activity predicted for each part of the material entombed. Table D-7 combines the previous tables to give a summation of radioactivity of the parts.

Table D-1. Entombed Stainless Steel Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 21 | SS-304 | 3.61E+00 | 1.60E-01 | 6.91E-02 | 2.76E-02 | 7.20E-03 | 4.65E-03 | 2.04E-03 |
| 22 | SS-304 | 3.38E-01 | 1.50E-02 | 6.46E-03 | 2.58E-03 | 6.73E-04 | 4.35E-04 | 1.91E-04 |
| 23 | SS-304 | 2.62E-03 | 1.16E-04 | 5.01E-05 | 2.00E-05 | 5.22E-06 | 3.37E-06 | 1.48E-06 |
| 24 | SS-304 | 4.65E-06 | 2.06E-07 | 8.90E-08 | 3.55E-08 | 9.27E-09 | 5.99E-09 | 2.63E-09 |
| 31 | SS-304 | 2.80E+04 | 1.24E+03 | 5.34E+02 | 2.13E+02 | 5.57E+01 | 3.60E+01 | 1.58E+01 |
| 32 | SS-304 | 2.80E+04 | 1.24E+03 | 5.34E+02 | 2.13E+02 | 5.57E+01 | 3.60E+01 | 1.58E+01 |
| 33 | SS-304 | 2.16E-06 | 9.58E-08 | 4.13E-08 | 1.65E-08 | 4.31E-09 | 2.78E-09 | 1.22E-09 |
| 34 | SS-304 | 5.59E-05 | 2.46E-06 | 1.06E-06 | 4.24E-07 | 1.11E-07 | 7.16E-08 | 3.14E-08 |
| 41 | SS-304 | 3.40E+04 | 1.51E+03 | 6.50E+02 | 2.59E+02 | 6.77E+01 | 4.37E+01 | 1.92E+01 |
| 42 | SS-304 | 9.45E+04 | 4.19E+03 | 1.81E+03 | 7.21E+02 | 1.88E+02 | 1.22E+02 | 5.34E+01 |
| 43 | SS-304 | 1.22E+05 | 5.41E+03 | 2.33E+03 | 9.30E+02 | 2.43E+02 | 1.57E+02 | 6.90E+01 |
| 44 | SS-304 | 5.60E+03 | 2.49E+02 | 1.07E+02 | 4.28E+01 | 1.12E+01 | 7.21E+00 | 3.17E+00 |
| 45 | SS-304 | 5.90E+03 | 2.62E+02 | 1.13E+02 | 4.50E+01 | 1.18E+01 | 7.60E+00 | 3.34E+00 |
| 46 | SS-304 | 3.08E+02 | 1.36E+01 | 5.88E+00 | 2.35E+00 | 6.13E-01 | 3.96E-01 | 1.74E-01 |
| 47 | SS-304 | 2.13E+04 | 9.45E+02 | 4.07E+02 | 1.63E+02 | 4.25E+01 | 2.74E+01 | 1.20E+01 |
| 48 | SS-304 | 1.86E+04 | 8.25E+02 | 3.56E+02 | 1.42E+02 | 3.71E+01 | 2.39E+01 | 1.05E+01 |
| 56 | SS-304 | 1.23E+02 | 5.44E+00 | 2.35E+00 | 9.36E-01 | 2.44E-01 | 1.58E-01 | 6.94E-02 |
| 71 | SS-304 | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |
| 72 | SS-304 | 1.24E+01 | 5.50E-01 | 2.37E-01 | 9.47E-02 | 2.47E-02 | 1.60E-02 | 7.02E-03 |
| 73 | SS-304 | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |
| 74 | SS-304 | 1.80E+01 | 7.97E-01 | 3.44E-01 | 1.37E-01 | 3.58E-02 | 2.31E-02 | 1.02E-02 |
| 75 | SS-304 | 7.52E+01 | 3.33E+00 | 1.44E+00 | 5.74E-01 | 1.50E-01 | 9.68E-02 | 4.25E-02 |
| Total | Curies | 3.58E+05 | 1.59E+04 | 6.85E+03 | 2.73E+03 | 7.14E+02 | 4.62E+02 | 2.03E+02 |

Table D-2. Entombed Carbon Steel Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 35 | A-7 | 9.24E-04 | 1.15E-04 | 4.01E-05 | 1.09E-05 | 8.82E-07 | 2.82E-07 | 1.54E-08 |
| 41 | A-212 | 1.97E+04 | 2.36E+03 | 8.56E+02 | 2.54E+02 | 3.00E+01 | 1.27E+01 | 1.49E+00 |
| 42 | A-212 | 4.84E+04 | 5.80E+03 | 2.11E+03 | 6.25E+02 | 7.37E+01 | 3.13E+01 | 3.67E+00 |
| 43 | A-212 | 1.29E+05 | 1.54E+04 | 5.61E+03 | 1.66E+03 | 1.96E+02 | 8.33E+01 | 9.77E+00 |
| 44 | A-212 | 3.31E+04 | 3.96E+03 | 1.44E+03 | 4.27E+02 | 5.04E+01 | 2.14E+01 | 2.51E+00 |
| 45 | A-212 | 3.56E+04 | 4.27E+03 | 1.55E+03 | 4.60E+02 | 5.42E+01 | 2.30E+01 | 2.70E+00 |
| 46 | A-212 | 1.52E+05 | 1.82E+04 | 6.59E+03 | 1.96E+03 | 2.31E+02 | 9.79E+01 | 1.15E+01 |
| 47 | A-212 | 1.31E+05 | 1.56E+04 | 5.68E+03 | 1.68E+03 | 1.99E+02 | 8.43E+01 | 9.89E+00 |
| 48 | A-212 | 3.47E+03 | 4.16E+02 | 1.51E+02 | 4.48E+01 | 5.29E+00 | 2.24E+00 | 2.63E-01 |
| Total | Curies | 5.52E+05 | 6.60E+04 | 2.40E+04 | 7.11E+03 | 8.40E+02 | 3.56E+02 | 4.18E+01 |

Table D-3. Entombed Lead Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 41 | Lead | 9.85E+01 | 5.47E-01 | 1.78E-02 | 8.40E-03 | 7.80E-03 | 7.58E-03 | 6.61E-03 |
| 42 | Lead | 2.59E+03 | 1.44E+01 | 4.67E-01 | 2.20E-01 | 2.05E-01 | 1.99E-01 | 1.74E-01 |
| 43 | Lead | 9.67E+03 | 5.38E+01 | 1.74E+00 | 8.24E-01 | 7.65E-01 | 7.44E-01 | 6.49E-01 |
| 44 | Lead | 4.99E+02 | 2.78E+00 | 8.99E-02 | 4.25E-02 | 3.95E-02 | 3.84E-02 | 3.35E-02 |
| 45 | Lead | 2.30E+03 | 1.28E+01 | 4.14E-01 | 1.96E-01 | 1.82E-01 | 1.77E-01 | 1.54E-01 |
| 46 | Lead | 1.29E+04 | 7.17E+01 | 2.32E+00 | 1.10E+00 | 1.02E+00 | 9.90E-01 | 8.64E-01 |
| 47 | Lead | 7.49E+03 | 4.17E+01 | 1.35E+00 | 6.37E-01 | 5.92E-01 | 5.76E-01 | 5.02E-01 |
| 48 | Lead | 1.24E+03 | 6.91E+00 | 2.24E-01 | 1.05E-01 | 9.80E-02 | 9.53E-02 | 8.31E-02 |
| 49 | Lead | 4.58E-01 | 2.55E-03 | 8.25E-05 | 3.89E-05 | 3.62E-05 | 3.52E-05 | 3.07E-05 |
| 80 | Lead | 1.47E+00 | 8.19E-03 | 2.65E-04 | 1.25E-04 | 1.16E-04 | 1.13E-04 | 9.86E-05 |
| Total | Curies | 3.68E+04 | 2.05E+02 | 6.62E+00 | 3.13E+00 | 2.91E+00 | 2.83E+00 | 2.47E+00 |

Table D-4 Entombed Cadmium Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 14 | Cadmium | 4.05E+04 | 6.91E+02 | 7.08E+01 | 5.98E+00 | 1.27E+00 | 1.20E+00 | 1.04E+00 |

Table D-5. Entombed Concrete Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 90 | Concrete | 1.45E-02 | 3.86E-04 | 3.43E-05 | 1.40E-05 | 3.76E-06 | 2.28E-06 | 3.49E-07 |
| 91 | Concrete | 2.11E+03 | 5.61E+01 | 4.99E+00 | 2.04E+00 | 5.46E-01 | 3.31E-01 | 5.07E-02 |
| 92 | Concrete | 3.92E+03 | 1.04E+02 | 9.26E+00 | 3.79E+00 | 1.01E+00 | 6.14E-01 | 9.40E-02 |
| 93 | Concrete | 7.26E+03 | 1.93E+02 | 1.72E+01 | 7.03E+00 | 1.88E+00 | 1.14E+00 | 1.74E-01 |
| 94 | Concrete | 1.87E+02 | 4.96E+00 | 4.41E-01 | 1.81E-01 | 4.84E-02 | 2.93E-02 | 4.50E-03 |
| 95 | Concrete | 2.41E+02 | 6.41E+00 | 5.70E-01 | 2.33E-01 | 6.24E-02 | 3.79E-02 | 5.81E-03 |
| 96 | Concrete | 5.30E+02 | 1.41E+01 | 1.25E+00 | 5.13E-01 | 1.37E-01 | 8.32E-02 | 1.28E-02 |
| 97 | Concrete | 8.36E-01 | 2.22E-02 | 1.97E-03 | 8.08E-04 | 2.16E-04 | 1.31E-04 | 2.01E-05 |
| 98 | Concrete | 3.98E+02 | 1.06E+01 | 9.39E-01 | 3.84E-01 | 1.03E-01 | 6.24E-02 | 9.57E-03 |
| 99 | Concrete | 1.06E+02 | 2.82E+00 | 2.51E-01 | 1.03E-01 | 2.75E-02 | 1.67E-02 | 2.55E-03 |
| 100 | Concrete | 9.41E+01 | 2.50E+00 | 2.22E-01 | 3.88E-02 | 3.43E-02 | 2.44E-02 | 1.48E-02 |
| Total | Curies | 1.48E+04 | 3.95E+02 | 3.51E+01 | 1.43E+01 | 3.85E+00 | 2.34E+00 | 3.69E-01 |

Table D-6 Entombed Aluminum Activity in Curies

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 11 | Al-5052 | 7.70E+05 | 2.63E+02 | 5.39E+01 | 1.38E+01 | 9.59E-01 | 2.54E-01 | 4.16E-04 |
| 12 | Al-6061 | 1.35E+05 | 8.73E+01 | 1.45E+01 | 3.64E+00 | 2.54E-01 | 6.74E-02 | 1.29E-04 |
| 13 | Al-6061 | 1.96E+05 | 1.26E+02 | 2.11E+01 | 5.28E+00 | 3.68E-01 | 9.72E-02 | 1.66E-04 |
| 51 | Al-5052 | 5.68E+03 | 1.94E+00 | 3.98E-01 | 1.02E-01 | 7.07E-03 | 1.87E-03 | 2.99E-06 |
| 52 | Al-5052 | 4.29E+02 | 1.46E-01 | 3.00E-02 | 7.67E-03 | 5.34E-04 | 1.41E-04 | 2.23E-07 |
| 53 | Al-5052 | 2.31E+01 | 7.89E-03 | 1.62E-03 | 4.14E-04 | 2.88E-05 | 7.61E-06 | 1.21E-08 |
| 54 | Al-5052 | 7.74E+01 | 2.64E-02 | 5.42E-03 | 1.38E-03 | 9.64E-05 | 2.55E-05 | 4.03E-08 |
| 55 | Al-5052 | 6.24E-04 | 2.13E-07 | 4.37E-08 | 1.12E-08 | 7.77E-10 | 2.05E-10 | 3.24E-13 |
| 57 | Al-6061 | 1.23E+03 | 7.90E-01 | 1.32E-01 | 3.30E-02 | 2.30E-03 | 6.07E-04 | 9.82E-07 |
| 58 | Al-6061 | 5.88E+03 | 3.78E+00 | 6.31E-01 | 1.58E-01 | 1.10E-02 | 2.91E-03 | 4.70E-06 |
| 59 | Al-6061 | 2.18E+02 | 1.40E-01 | 2.34E-02 | 5.86E-03 | 4.08E-04 | 1.08E-04 | 1.73E-07 |
| 61 | Al-5050 | 3.17E+05 | 1.67E+02 | 2.05E+01 | 4.97E+00 | 3.45E-01 | 9.14E-02 | 1.74E-04 |
| 62 | Al-5050 | 2.55E-01 | 1.34E-04 | 1.65E-05 | 3.99E-06 | 2.77E-07 | 7.33E-08 | 1.36E-10 |
| 80 | Al-6061 | 3.43E+02 | 2.20E-01 | 3.68E-02 | 9.22E-03 | 6.41E-04 | 1.69E-04 | 2.73E-07 |
| 81 | Al-6061 | 2.65E-03 | 1.70E-06 | 2.48E-07 | 7.12E-08 | 4.95E-09 | 1.31E-09 | 2.10E-12 |
| Total | Curies | 1.43E+06 | 6.50E+02 | 1.11E+02 | 2.80E+01 | 1.95E+00 | 5.16E-01 | 8.94E-04 |

Table D-7. Activity of Entombed Materials in Curies

| Part | Material | Years after Shutdown 0 | 1 | 5 | 10 | 20 | 25 | 50 |
|---|---|---|---|---|---|---|---|---|
| 11 | Al-5052 | 7.70E+05 | 2.63E+02 | 5.39E+01 | 1.38E+01 | 9.59E-01 | 2.54E-01 | 4.16E-04 |
| 12 | Al-6061 | 1.35E+05 | 8.73E+01 | 1.45E+01 | 3.64E+00 | 2.54E-01 | 6.74E-02 | 1.29E-04 |
| 13 | Al-6061 | 1.96E+05 | 1.26E+02 | 2.11E+01 | 5.28E+00 | 3.68E-01 | 9.72E-02 | 1.66E-04 |
| 14 | Cadmium | 4.05E+04 | 6.91E+02 | 7.08E+01 | 5.98E+00 | 1.27E+00 | 1.20E+00 | 1.04E+00 |
| 21 | SS-304 | 3.61E+00 | 1.60E-01 | 6.91E-02 | 2.76E-02 | 7.20E-03 | 4.65E-03 | 2.04E-03 |
| 22 | SS-304 | 3.38E-01 | 1.50E-02 | 6.46E-03 | 2.58E-03 | 6.73E-04 | 4.35E-04 | 1.91E-04 |
| 23 | SS-304 | 2.62E-03 | 1.16E-04 | 5.01E-05 | 2.00E-05 | 5.22E-06 | 3.37E-06 | 1.48E-06 |
| 24 | SS-304 | 4.65E-06 | 2.06E-07 | 8.90E-08 | 3.55E-08 | 9.27E-09 | 5.99E-09 | 2.63E-09 |
| 31 | SS-304 | 2.80E+04 | 1.24E+03 | 5.34E+02 | 2.13E+02 | 5.57E+01 | 3.60E+01 | 1.58E+01 |
| 32 | SS-304 | 2.80E+04 | 1.24E+03 | 5.34E+02 | 2.13E+02 | 5.57E+01 | 3.60E+01 | 1.58E+01 |
| 33 | SS-304 | 2.16E-06 | 9.58E-08 | 4.13E-08 | 1.65E-08 | 4.31E-09 | 2.78E-09 | 1.22E-09 |
| 34 | SS-304 | 5.59E-05 | 2.46E-06 | 1.06E-06 | 4.24E-07 | 1.11E-07 | 7.16E-08 | 3.14E-08 |
| 35 | A-7 | 9.24E-04 | 1.15E-04 | 4.01E-05 | 1.09E-05 | 8.82E-07 | 2.82E-07 | 1.54E-08 |
| 41 | A-212 | 1.97E+04 | 2.36E+03 | 8.56E+02 | 2.54E+02 | 3.00E+01 | 1.27E+01 | 1.49E+00 |
| | Lead | 9.85E+01 | 5.47E-01 | 1.78E-02 | 8.40E-03 | 7.80E-03 | 7.58E-03 | 6.61E-03 |
| | SS-304 | 3.40E+04 | 1.51E+03 | 6.50E+02 | 2.59E+02 | 6.77E+01 | 4.37E+01 | 1.92E+01 |
| 42 | A-212 | 4.84E+04 | 5.80E+03 | 2.11E+03 | 6.25E+02 | 7.37E+01 | 3.13E+01 | 3.67E+00 |
| | Lead | 2.59E+03 | 1.44E+01 | 4.67E-01 | 2.20E-01 | 2.05E-01 | 1.99E-01 | 1.74E-01 |
| | SS-304 | 9.45E+04 | 4.19E+03 | 1.81E+03 | 7.21E+02 | 1.88E+02 | 1.22E+02 | 5.34E+01 |
| 43 | A-212 | 1.29E+05 | 1.54E+04 | 5.61E+03 | 1.66E+03 | 1.96E+02 | 8.33E+01 | 9.77E+00 |
| | Lead | 9.67E+03 | 5.38E+01 | 1.74E+00 | 8.24E-01 | 7.65E-01 | 7.44E-01 | 6.49E-01 |
| | SS-304 | 1.22E+05 | 5.41E+03 | 2.33E+03 | 9.30E+02 | 2.43E+02 | 1.57E+02 | 6.90E+01 |
| 44 | A-212 | 3.31E+04 | 3.96E+03 | 1.44E+03 | 4.27E+02 | 5.04E+01 | 2.14E+01 | 2.51E+00 |
| | Lead | 4.99E+02 | 2.78E+00 | 8.99E-02 | 4.25E-02 | 3.95E-02 | 3.84E-02 | 3.35E-02 |
| | SS-304 | 5.60E+03 | 2.49E+02 | 1.07E+02 | 4.28E+01 | 1.12E+01 | 7.21E+00 | 3.17E+00 |
| 45 | A-212 | 3.56E+04 | 4.27E+03 | 1.55E+03 | 4.60E+02 | 5.42E+01 | 2.30E+01 | 2.70E+00 |
| | Lead | 2.30E+03 | 1.28E+01 | 4.14E-01 | 1.96E-01 | 1.82E-01 | 1.77E-01 | 1.54E-01 |
| | SS-304 | 5.90E+03 | 2.62E+02 | 1.13E+02 | 4.50E+01 | 1.18E+01 | 7.60E+00 | 3.34E+00 |
| 46 | A-212 | 1.52E+05 | 1.82E+04 | 6.59E+03 | 1.96E+03 | 2.31E+02 | 9.79E+01 | 1.15E+01 |
| | Lead | 1.29E+04 | 7.17E+01 | 2.32E+00 | 1.10E+00 | 1.02E+00 | 9.90E-01 | 8.64E-01 |
| | SS-304 | 3.08E+02 | 1.36E+01 | 5.88E+00 | 2.35E+00 | 6.13E-01 | 3.96E-01 | 1.74E-01 |
| 47 | A-212 | 1.31E+05 | 1.56E+04 | 5.68E+03 | 1.68E+03 | 1.99E+02 | 8.43E+01 | 9.89E+00 |
| | Lead | 7.49E+03 | 4.17E+01 | 1.35E+00 | 6.37E-01 | 5.92E-01 | 5.76E-01 | 5.02E-01 |
| | SS-304 | 2.13E+04 | 9.45E+02 | 4.07E+02 | 1.63E+02 | 4.25E+01 | 2.74E+01 | 1.20E+01 |
| 48 | A-212 | 3.47E+03 | 4.16E+02 | 1.51E+02 | 4.48E+01 | 5.29E+00 | 2.24E+00 | 2.63E-01 |
| | Lead | 1.24E+03 | 6.91E+00 | 2.24E-01 | 1.05E-01 | 9.80E-02 | 9.53E-02 | 8.31E-02 |
| | SS-304 | 1.86E+04 | 8.25E+02 | 3.56E+02 | 1.42E+02 | 3.71E+01 | 2.39E+01 | 1.05E+01 |
| 49 | Lead | 4.58E-01 | 2.55E-03 | 8.25E-05 | 3.89E-05 | 3.62E-05 | 3.52E-05 | 3.07E-05 |

Table D-7. Activity of Entombed Materials in Curies (Continued)

| | | Years after Shutdown | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part | Material | 0 | 1 | 5 | 10 | 20 | 25 | 50 |
| 51 | Al-5052 | 5.68E+03 | 1.94E+00 | 3.98E-01 | 1.02E-01 | 7.07E-03 | 1.87E-03 | 2.99E-06 |
| 52 | Al-5052 | 4.29E+02 | 1.46E-01 | 3.00E-02 | 7.67E-03 | 5.34E-04 | 1.41E-04 | 2.23E-07 |
| 53 | Al-5052 | 2.31E+01 | 7.89E-03 | 1.62E-03 | 4.14E-04 | 2.88E-05 | 7.61E-06 | 1.21E-08 |
| 54 | Al-5052 | 7.74E+01 | 2.64E-02 | 5.42E-03 | 1.38E-03 | 9.64E-05 | 2.55E-05 | 4.03E-08 |
| 55 | Al-5052 | 6.24E-04 | 2.13E-07 | 4.37E-08 | 1.12E-08 | 7.77E-10 | 2.05E-10 | 3.24E-13 |
| 56 | SS-304 | 1.23E+02 | 5.44E+00 | 2.35E+00 | 9.36E-01 | 2.44E-01 | 1.58E-01 | 6.94E-02 |
| 57 | Al-6061 | 1.23E+03 | 7.90E-01 | 1.32E-01 | 3.30E-02 | 2.30E-03 | 6.07E-04 | 9.82E-07 |
| 58 | Al-6061 | 5.88E+03 | 3.78E+00 | 6.31E-01 | 1.58E-01 | 1.10E-02 | 2.91E-03 | 4.70E-06 |
| 59 | Al-6061 | 2.18E+02 | 1.40E-01 | 2.34E-02 | 5.86E-03 | 4.08E-04 | 1.08E-04 | 1.73E-07 |
| 61 | Al-5050 | 3.17E+05 | 1.67E+02 | 2.05E+01 | 4.97E+00 | 3.45E-01 | 9.14E-02 | 1.74E-04 |
| 62 | Al-5050 | 2.55E-01 | 1.34E-04 | 1.65E-05 | 3.99E-06 | 2.77E-07 | 7.33E-08 | 1.36E-10 |
| 71 | SS-304 | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |
| 72 | SS-304 | 1.24E+01 | 5.50E-01 | 2.37E-01 | 9.47E-02 | 2.47E-02 | 1.60E-02 | 7.02E-03 |
| 73 | SS-304 | 1.00E-04 | 4.44E-06 | 1.91E-06 | 7.64E-07 | 2.00E-07 | 1.29E-07 | 5.66E-08 |
| 74 | SS-304 | 1.80E+01 | 7.97E-01 | 3.44E-01 | 1.37E-01 | 3.58E-02 | 2.31E-02 | 1.02E-02 |
| 75 | SS-304 | 7.52E+01 | 3.33E+00 | 1.44E+00 | 5.74E-01 | 1.50E-01 | 9.68E-02 | 4.25E-02 |
| 80 | Al-6061 | 3.43E+02 | 2.20E-01 | 3.68E-02 | 9.22E-03 | 6.41E-04 | 1.69E-04 | 2.73E-07 |
| | Lead | 1.47E+00 | 8.19E-03 | 2.65E-04 | 1.25E-04 | 1.16E-04 | 1.13E-04 | 9.86E-05 |
| 81 | Al-6061 | 2.65E-03 | 1.70E-06 | 2.48E-07 | 7.12E-08 | 4.95E-09 | 1.31E-09 | 2.10E-12 |
| 90 | Concrete | 1.45E-02 | 3.86E-04 | 3.43E-05 | 1.40E-05 | 3.76E-06 | 2.28E-06 | 3.49E-07 |
| 91 | Concrete | 2.11E+03 | 5.61E+01 | 4.99E+00 | 2.04E+00 | 5.46E-01 | 3.31E-01 | 5.07E-02 |
| 92 | Concrete | 3.92E+03 | 1.04E+02 | 9.26E+00 | 3.79E+00 | 1.01E+00 | 6.14E-01 | 9.40E-02 |
| 93 | Concrete | 7.26E+03 | 1.93E+02 | 1.72E+01 | 7.03E+00 | 1.88E+00 | 1.14E+00 | 1.74E-01 |
| 94 | Concrete | 1.87E+02 | 4.96E+00 | 4.41E-01 | 1.81E-01 | 4.84E-02 | 2.93E-02 | 4.50E-03 |
| 95 | Concrete | 2.41E+02 | 6.41E+00 | 5.70E-01 | 2.33E-01 | 6.24E-02 | 3.79E-02 | 5.81E-03 |
| 96 | Concrete | 5.30E+02 | 1.41E+01 | 1.25E+00 | 5.13E-01 | 1.37E-01 | 8.32E-02 | 1.28E-02 |
| 97 | Concrete | 8.36E-01 | 2.22E-02 | 1.97E-03 | 8.08E-04 | 2.16E-04 | 1.31E-04 | 2.01E-05 |
| 98 | Concrete | 3.98E+02 | 1.06E+01 | 9.39E-01 | 3.84E-01 | 1.03E-01 | 6.24E-02 | 9.57E-03 |
| 99 | Concrete | 1.06E+02 | 2.82E+00 | 2.51E-01 | 1.03E-01 | 2.75E-02 | 1.67E-02 | 2.55E-03 |
| 100 | Concrete | 9.41E+01 | 2.50E+00 | 2.22E-01 | 3.88E-02 | 3.43E-02 | 2.44E-02 | 1.48E-02 |
| Total | Curies | 2.43E+06 | 8.38E+04 | 3.11E+04 | 9.90E+03 | 1.56E+03 | 8.25E+02 | 2.48E+02 |

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# Vita

William Augustus Lamb [redacted], the son of Robert Leslie Lamb and Beatrice Irene Lamb. After completing high school in 1971 at Storm Lake High School in Storm Lake, Iowa, he enlisted in the United States Air Force. Working as a ground radio equipment repairman and a tactical air command and control specialist, he completed his education requirements off duty to become selected for the Airman Education and Commissioning program in 1981. Graduating from Arizona State University in December 1984 with a Bachelor of Science in Engineering (Nuclear Sciences), he received his commission as a Lieutenant in the United States Air Force Reserve in April 1985. He received a regular commission in 1988. His first assignment was to the Air Force Technical Application Center at Patrick AFB, Florida where he worked as a program manager for computer software development. In 1988, he was assigned to the Air Force Institute of Technology in the graduate nuclear engineering program. Following the AFIT assignment, he was assigned to the Air Force Weapons Laboratory at Kirkland AFB, New Mexico.

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SECURITY CLASSIFICATION OF THIS PAGE

# REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

| | |
|---|---|
| 1a. REPORT SECURITY CLASSIFICATION<br>UNCLASSIFIED | 1b. RESTRICTIVE MARKINGS |
| 2a. SECURITY CLASSIFICATION AUTHORITY | 3. DISTRIBUTION/AVAILABILITY OF REPORT<br>Approved for public release; distribution unlimited |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S)<br>AFIT/GNE/ENP/90M-4 | 5. MONITORING ORGANIZATION REPORT NUMBER(S) |
| 6a. NAME OF PERFORMING ORGANIZATION<br>School of Engineering<br>6b. OFFICE SYMBOL (If applicable)<br>AFIT/ENP | 7a. NAME OF MONITORING ORGANIZATION |
| 6c. ADDRESS (City, State, and ZIP Code)<br>Air Force Institute of Technology<br>Wright-Patterson AFB OH 45433-6583 | 7b. ADDRESS (City, State, and ZIP Code) |
| 8a. NAME OF FUNDING/SPONSORING ORGANIZATION<br>8b. OFFICE SYMBOL (If applicable) | 9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER |
| 8c. ADDRESS (City, State, and ZIP Code) | 10. SOURCE OF FUNDING NUMBERS<br>PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO / WORK UNIT ACCESSION NO |

11. TITLE (Include Security Classification)
THE AIR FORCE NUCLEAR ENGINEERING CENTER STRUCTURAL ACTIVATION AND INTEGRITY EVALUATION

12. PERSONAL AUTHOR(S)
William A. Lamb, B.S., Captain, USAF

| 13a. TYPE OF REPORT | 13b. TIME COVERED | 14. DATE OF REPORT (Year, Month, Day) | 15. PAGE COUNT |
|---|---|---|---|
| MS Thesis | FROM ______ TO ______ | 1990 March | 109 |

16. SUPPLEMENTARY NOTATION

| 17. COSATI CODES | | |
|---|---|---|
| FIELD | GROUP | SUB-GROUP |
| 18 | 09 | |

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Nuclear Reactors, Entombed Reactors, Neutron Activation, THESES, Radioactivity, [illegible], Military Facilities.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Thesis Advisor: Ronald F. Tuttle, Lt Col, USAF
Assistant Professor and Deputy Head
Department of Engineering Physics

| | |
|---|---|
| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT<br>☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS | 21. ABSTRACT SECURITY CLASSIFICATION<br>UNCLASSIFIED |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Ronald F. Tuttle, Lt Col, USAF | 22b. TELEPHONE (Include Area Code)<br>(513) 255-4498<br>22c. OFFICE SYMBOL<br>AFIT/ENP |

DD Form 1473, JUN 86 Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

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The purpose of this study was to investigate three areas: (1) the entombed radioactivity of the Air Force Nuclear Engineering Center (AFNEC) Test Facility located in Area B, Building 470, Wright-Patterson AFB, Ohio, (2) the integrity of the materials incased in the concrete to determine if they would be susceptible to corrosion or deterioration, and (3) the comparison of cost of dismantlement of the existing facility or continued surveillance of the existing facility. The ORIGEN2 computer code was used to calculate an upper bound of radioactivity entombed within AFNEC. The initial calculated activity, 2,460,000 Curies, has decayed by three orders of magnitude since the cessation of operation (20 years later - 1,560 Curies). The activated structural components consisted of 5 distinct materials; aluminum, stainless steel, carbon steel, lead, and concrete. Of these materials, aluminum dominated the initial radioactivity with nearly 60% of the total activity attributed to it. The carbon steel became the dominant contributor to the total radioactivity with over 50% of the total activity at 20 years after shutdown. Stainless steel structural components will contribute over 80% of the total activity at 50 years when the calculated total radioactivity has decreased to less than 300 Curies. The integrity of the AFNEC structure was determined to adequately contain the entombed structural radioactivity at background levels for the lifetime of the entombment. Finally, the estimated dismantling costs of $42 million projected by Martin-Marietta are within industry estimates for dismantling a nuclear reactor.